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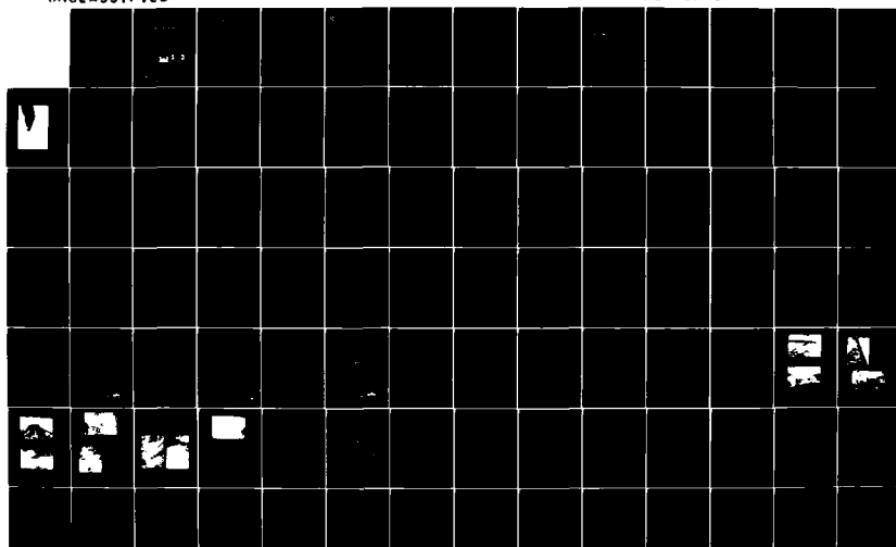
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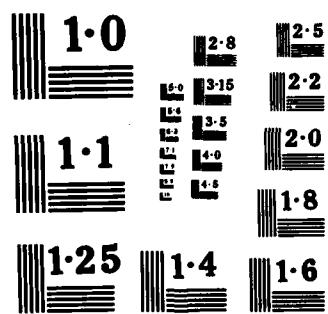
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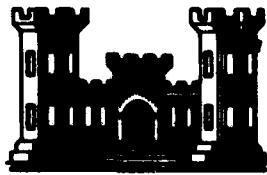


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CONNECTICUT RIVER BASIN
WOODSTOCK, VERMONT

VONDELL RESERVOIR DAM
VT 00160

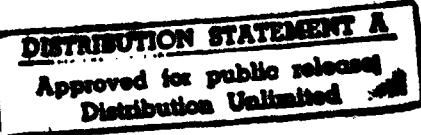
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

OCT., 1980

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| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|-----------------------|---|
| 1. REPORT NUMBER VT 00160 | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) Vondell Reservoir Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS | | 5. TYPE OF REPORT & PERIOD COVERED INSPECTION REPORT |
| 7. AUTHOR(s) U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION | | 6. PERFORMING ORG. REPORT NUMBER |
| 8. PERFORMING ORGANIZATION NAME AND ADDRESS | | 8. CONTRACT OR GRANT NUMBER(s) |
| 11. CONTROLLING OFFICE NAME AND ADDRESS DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
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| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) DAMS, INSPECTION, DAM SAFETY, Connecticut River Basin Woodstock VT. Vondell Brook | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam is a zoned earthfill embankment structure about 580 ft. long and 33 ft. high. The dam is considered to be in fair condition. No evidence of structural instability was observed. It is small in size with a significant hazard potential. There are a few recommendations which must be undertaken by the owner. ← | | |



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO
ATTENTION OF:
NEEDED

MAR 06 1981

Honorable Richard A. Snelling
Governor of the State of Vermont
State Capitol
Montpelier, Vermont 05602

Dear Governor Snelling:

Inclosed is a copy of the Vondell Reservoir Dam (VT-00160) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Water Resources, the cooperating agency for the State of Vermont. In addition, a copy of the report has also been furnished the owner, Woodstock Aqueduct Company, Woodstock, Vermont 05091.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Water Resources for your cooperation in carrying out this program.

Sincerely,

C. E. EDGAR, III
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

VONDELL RESERVOIR DAM

VT 00160

CONNECTICUT RIVER BASIN

WOODSTOCK, VERMONT

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

| | |
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BRIEF ASSESSMENT
PHASE I INSPECTION REPORT
NATIONAL PROGRAM OF INSPECTION OF DAMS

Identification Number: VT 00160
Name of Dam: VONDELL RESERVOIR DAM
Town: WOODSTOCK
County and State: WINDSOR COUNTY, VERMONT
Stream: VONDELL BROOK
Date of Inspection: AUGUST 5, 1980

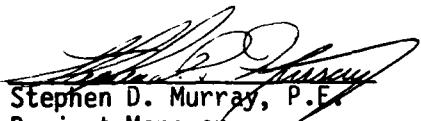
The dam, constructed in 1962, is a zoned earthfill embankment structure approximately 580 feet long and 33 feet in height. The upstream slope is inclined at 3 horizontal to 1 vertical, the downstream slope at 2 horizontal to 1 vertical. A 7 foot long reinforced concrete overflow service spillway exists near the left end of the dam, and an emergency earthen overflow spillway with a crest approximately 60 feet long is cut into the left abutment. Two valved low level outlets, 4 inches, and 8 inches in diameter penetrate the dam at its approximate center and are reported to be operable.

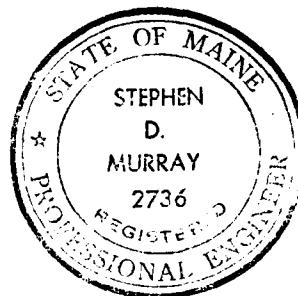
The dam impounds the headwaters of a watercourse locally called Vondell Brook, which flows in a southerly direction about 4600 feet to Cox District Reservoir. The outlet from the Cox Reservoir flows southeasterly about 8600 feet to its confluence with the Ottauquechee River. Vondell Dam was constructed and is used for emergency water supply. The impoundment is 1200 feet in length with a surface area of 7.4 acres. Normal storage capacity is 73 acre-ft.

Based upon the visual inspection and the review of available data regarding this facility, the dam is considered to be in FAIR condition. No evidence of structural instability was observed. Some spalling and cracking of the concrete service spillway was noted, some ruts from mowing activity were apparent on the side slopes, and a shallow trench intended to discourage vehicular trespassing has been dug along a portion of the downstream toe.

In accordance with Corps of Engineers Guidelines and the size (SMALL) and hazard (SIGNIFICANT) classification of the dam, the Test Flood selected was equivalent to the 100-year recurrence flood. Peak inflow to the impoundment is 385 cfs; routed peak outflow from the dam is 320 cfs with the water elevation 2.3 feet below the top of dam. The spillway capacity is 1400 cfs or about 438 percent of the routed Test Flood outflow.

It is recommended that the owner retain a qualified registered engineer to investigate the causes of the concrete cracking of the inlet structure and to design corrective measures; to design a means to eliminate the pressure conduit through the dam core; to supervise tree removal and backfill operations and to perform inspections of the emergency spillway. This and remedial measures which are discussed in Section 7 should be instituted within one year of the owner's receipt of this report.


Stephen D. Murray, P.E.
Project Manager
James W. Sewall Company



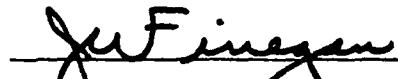
This Phase I Inspection Report on Vondell Reservoir Dam (VT-00160) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.



ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

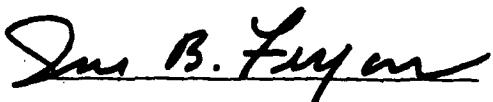


CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division



JOSEPH W. FINEGAN, JR., CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:



JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff"), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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SECTION 5: EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 GENERAL

The project is basically a low surcharge-high spillage earthfill dam, originally constructed and currently used to impound water for municipal water supply purposes.

The tributary watershed consists of 0.65 square miles of undeveloped terrain, virtually 100% wooded and containing no significant storage other than Vondell Reservoir. Vondell Reservoir has a surface area of 7.4 acres constituting less than 2% of the total drainage area. With NGVD elevations ranging from 1,140 feet to over 1,600 feet and an average slope of nearly 11%, the watershed is considered mountainous.

Vondell Reservoir Dam is an earth embankment equipped with a 7 foot long overflow service spillway and a 60 foot long emergency spillway crest 2 feet higher. Total spillway discharge capacity is about 438% of the routed Test Flood outflow.

5.2 DESIGN DATA

No design data are known to exist for this project.

5.3 EXPERIENCE DATA

The maximum known flood at the dam site reportedly occurred June 30, 1973. No specific information concerning this occurrence was located. No information on serious problem situations arising at the dam were found, and it does not appear the dam has been overtopped.

5.4 TEST FLOOD ANALYSIS

The "Recommended Guidelines for Safety Inspection of Dams" presents a test flood range for significant hazard small size dams of the 100 year frequency to one-half the Probable Maximum Flood (PMF). Selection of the test flood to be utilized in the analysis of a particular dam is dependent upon the proximity of the dam to the upper or lower limits of its size category. Because the dam is near the lower limits of its size category, the test flood selected is equivalent to the 100 year frequency flood. The magnitude of this flood was estimated utilizing Weather Bureau projections of the ratio of the 100 year frequency precipitation to the probable maximum precipitation as presented in U.S. Department of Commerce T.P. #40 and applying that ratio to the PMF. The tributary watershed consists of 0.65 square miles of steep undeveloped terrain, virtually 100% wooded. Extrapolating from the curve for "mountainous" watersheds contained in the "Preliminary Guidance for Estimating Maximum Probable Discharge", dated March, 1978, peak inflow to Vondell Reservoir is 385 cfs. Routed Test Flood outflow, with the pool initially at normal level (el. 102.5 assumed datum) is 320 cfs with the service spillway overtopped 3.2 feet or 2.3 feet below the top of the dam. Based upon hydraulics computations, the combined capacity of the spillways is 1400 cfs, which is approximately 438% of the routed Test Flood outflow at the top of the dam.

SECTION 4: OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 OPERATIONAL PROCEDURES

a. General - No formal operating procedure, as such, is known to exist. Vondell Reservoir impounds supplementary water for Cox Reservoir downstream. There is no pipe connection between the two. If water is needed in Cox Reservoir, either the 4 inch or 8 inch outlet valves of Vondell are opened and water flows down the streambed to Cox Reservoir.

b. Warning System - No warning system is known to exist.

4.2 MAINTENANCE PROCEDURES

a. General - As far as could be determined, the dam receives no regular maintenance. It is presumed that the cutting of the vegetative cover is on an irregular basis.

b. Operating Facilities - No formal plan for the maintenance of operating facilities was disclosed.

4.3 EVALUATION

The operation and maintenance procedures at this dam are inadequate to ensure that all problems encountered can be remedied within a reasonable period of time. The owner should establish a written operation and maintenance procedure as well as a downstream warning system to follow in the event of an emergency at the dam.

Erosion could occur along the ruts on the slopes and crest of the dam and the right wing wall of the emergency spillway during surface runoff.

If the small trees and bushes along the right training wall of the emergency spillway are allowed to remain the resulting root systems could create seepage paths which could lead to internal erosion of the dam.

The bushes and trees growing in and overhanging the spillway and outlet channels could restrict the flow of water discharged into the channels.

Continued cracking and spalling of the concrete of the inlet structure could endanger its stability.

The 4 inch and 8 inch diameter outlet pipes are uncontrolled pressure conduits under the center of the dam. The overflow spillway is potentially subject to erosion because of its curvature and steep slope.

A 6 inch diameter corrugated metal pipe exits at the downstream toe of the dam at about Sta 3+30. The pipe, shown in Photo 9, is apparently the outlet pipe from the downstream toe drain in the dam.

A trench had been excavated prior to the time of inspection at the downstream toe of the dam between about Sta 4+20 and Sta 5+30, Photo 10. The purpose of this trench, as determined from the owner, was to discourage vehicular trespass on the dam face. The trench was about 4 feet wide and 3 feet deep. As shown in Photo 10, water was observed seeping into the trench at about Sta 5+30. The soil in the bottom of the trench was soft and wet.

c. Appurtenant Structures

Emergency Spillway

A grass-covered emergency spillway is located in the left abutment to the left of the service spillway inlet. The inlet to the emergency spillway is shown in Photo 11. The embankment forms the right training wall and the left abutment forms the left training wall for the spillway. As shown in Photo 11 the right training wall, which is part of the embankment, is covered with bushes and small trees. Ruts due to vehicular traffic were observed on the right slope of the training wall, as seen in Photo 11.

d. Reservoir Area - There are no indications of instability along the banks of the reservoir in the vicinity of the dam.

e. Downstream Channel - There are two downstream channels, one downstream from the emergency spillway and the other downstream from the outlet pipes. The two downstream channels are referred to as the spillway channel and the outlet channel, respectively, in the following sections. The two channels join about 100 feet downstream of the dam.

The floor of the spillway channel is grass-covered as shown in Photo 11. Bushes and trees are growing in the channel at its end, where it joins the outlet channel.

The floor of the outlet channel is covered with boulders. Grass is growing over the outlet pipes, and bushes and trees are overhanging the channel as shown in Photo 8.

3.2 EVALUATION

On the basis of the results of the visual inspection, Vondell Reservoir dam is judged to be in fair condition.

The trench excavated at the downstream toe of the dam, if allowed to remain open, could result in seepage conditions which could lead to internal erosion of the dam.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General - At the time of inspection on August 5, 1980, the water level in Vondell Reservoir, impounded by the dam, was one inch over the spillway. The weather was hot and humid. The general condition of this dam is fair.

b. Dam - The dam consists of an earth embankment with approximately 2 horizontal to 1 vertical downstream and 3 horizontal to 1 vertical upstream slopes. A vegetated emergency spillway is located on the left abutment immediately adjacent to the dam.

Upstream Slope

The upstream slope of the dam is grass-covered as shown in Photo 1. No riprap was observed on the slope. Minor erosion was observed on the upstream slope at the reservoir elevation.

The inlet structure for the service spillway, shown in Photo 2, is located on the upstream slope of the dam at the left end of the dam. Some cracking and spalling of the concrete has occurred as shown in Photo 3. Adjacent to the left side of the inlet structure there is a small depression in the backfill as shown in Photo 4.

Crest

The crest of the dam is about 12 feet wide and covered with grass which has been recently mowed, Photo 5. Ruts due apparently to the mowing equipment or other vehicular traffic, were observed on the crest.

Downstream Slope

The downstream slope is grass-covered as shown in Photo 6. The grass had been recently mowed. Ruts, due apparently to the mowing equipment, were observed on the downstream slope. No evidence of seepage, sloughing or erosion was visible.

A valve chamber is located on the downstream slope at about Sta 3+10 as shown in Photo 6. (The station numbers referred to in the following sections were obtained from Gratiot Engineering Co. Drawing No. 5-137,D-3, titled "General Arrangement" and dated April 6, 1962.) The valve chamber contains the controls for a 4 inch diameter outlet pipe and 8 inch diameter outlet pipe which pass through the dam and exit at the downstream toe of the dam at about Sta 3+00 where they discharge into an outlet channel, Photo 7.

The 54 inch diameter service spillway outlet pipe discharges into the outlet channel at the downstream toe of the dam at about Sta 2+90 as shown in Photo 8.

SECTION 2: ENGINEERING DATA

2.1 DESIGN

a. Available Data - Available data consists of five sheets by the Gratiot Engineering Company, Woodstock, Vermont; Vondell Reservoir General Arrangement Drawing D-3; Stripped Foundation Plan and Sections Drawing D-4; Outlet Works Details Drawing D-5; Service Spillway Details Drawing D-6 and Miscellaneous Details Drawing D-7. All sheets are dated April, 1962.

b. Design Features - The drawings, computations and inspection reports indicate the design features stated in Section 1.

c. Design Data - Design data consists of information on the drawings by the Gratiot Engineering Company, as listed in "Available Data".

2.2 CONSTRUCTION

a. Available Data - Information as contained in any plans, drawings, or specifications previously listed in "Design Data" or Appendix B.

b. Construction Considerations - Correspondence in the files of the Vermont Water Resources Board indicates that during construction of the dam, a slab footing under the service spillway inlet was made necessary by the failure to encounter ledge as expected. The length of the spillway pipe was reduced from 208 feet to 192 feet.

2.3 OPERATION

Pond level readings are not taken on any regular schedule. No formal operation procedures are known to exist.

2.4 EVALUATION

a. Availability - Existing data was provided by the State of Vermont Agency of Environmental Conservation.

b. Adequacy - Detailed hydrologic/hydraulic data were not available. Design data and field measurements were utilized in conjunction with New England Division - Army Corps of Engineers "Preliminary Guidance for Estimating Maximum Probable Discharges" to perform the computations of outflow capacity.

The detailed engineering data required to perform an in-depth stability analysis of the dam was not available. The final assessment of the dam, therefore, must be based primarily on visual inspection, performance history, and spillway capacity computations.

c. Validity - A comparison of records, data, and visual observations reveals no significant discrepancies, other than those noted above, between design and as-built dimensions.

| | <u>Service</u> | <u>Emergency</u> |
|------------------------------|--------------------|-------------------------------|
| 6. Downstream channel: | Original streambed | Earthen Channel to streambed |
| 7. General: | N/A | N/A |
| j. Regulating Outlets | | |
| 1. Invert: | | 80 |
| 2. Size: | | 1 - 8" dia., 1 - 4" dia. |
| 3. Description: | | 2 C.I. low level drains |
| 4. Control mechanism: | | Manually operated gate valves |
| 5. Other: | | N/A |

f. Reservoir Surface

| | |
|------------------------|-----------|
| 1. Normal pool: | 7.4 acres |
| 2. Flood control pool: | N/A |
| 3. Spillway crest: | 7.4 acres |
| 4. Test flood pool: | 8.5 acres |
| 5. Top of dam: | 9 acres |

g. Dam

| | |
|---------------------|--|
| 1. Type: | Zoned Earthfill |
| 2. Length: | 580± ft |
| 3. Height: | 33± ft |
| 4. Top Width: | 12 ft |
| 5. Side Slopes: | 3H to 1V Upstream 2H to 1V Downstream |
| 6. Zoning: | Shell, Core, and Drain |
| 7. Impervious Core: | to el. 108 |
| 8. Cutoff: | Trench |
| 9. Grout Curtain: | N/A |
| 10. Other: | N/A |

h. Diversion and Regulating Tunnel

i. Spillway

| | <u>Service</u> | <u>Emergency</u> |
|----------------------|----------------------|------------------|
| 1. Type: | Concrete Overflow | Earthen |
| 2. Length of weir: | 7 ft | 60 ft |
| 3. Crest el. | 102.5 | 104.5 |
| 4. Gates: | N/A | N/A |
| 5. Upstream channel: | N/A | N/A |

8. Total project discharge at top of dam el. 108: 1410 cfs
 9. Total project discharge at test flood el. 105.7: 330 cfs
 c. Elevation (Feet, assumed datum)
 (Elevation 102.5 assumed datum is between elevation 1,130 feet and 1,140 feet NGVD)

| | |
|--|--------|
| 1. Streambed at toe of dam: | 75 |
| 2. Bottom of cutoff: | 68+ |
| 3. Maximum tailwater: | N/A |
| 4. Recreation pool: | 102.5 |
| 5. Full flood control pool: | N/A |
| 6. Spillway crest (Ungated): | 102.5 |
| 7. Design surcharge (original design): | 105.1+ |
| 8. Top of dam: | 108 |
| 9. Test flood surcharge: | 105.7 |

d. Reservoir

| | |
|-----------------------------------|----------|
| 1. Length of normal pool: | 1200+ ft |
| 2. Length of flood control pool: | 1200+ ft |
| 3. Length of spillway crest pool: | 1200+ ft |
| 4. Length of pool at top of dam: | 1200+ ft |
| 5. Length of test flood pool: | 1200+ ft |

e. Storage

| | |
|-------------------------|-------------|
| 1. Normal pool: | 73 acre-ft |
| 2. Flood control pool: | N/A |
| 3. Spillway crest pool: | 73 acre-ft |
| 4. Top of dam: | 114 acre-ft |
| 5. Test flood pool: | 92 acre-ft |

g. Purpose of Dam - Municipal water storage.

h. Design and Construction History - The following information is believed to be accurate, based upon plans and correspondence available and from conversations with persons familiar with the history of the dam. The dam was designed for the present owner in 1962 by the Gratiot Engineering Company, Woodstock, Vermont. A public hearing, as required by the state, was held April 10, 1962, and a Hearing Order issued June 1, 1962, allowing the project to proceed to construction. Construction was completed in 1963. No unusual construction problems or conditions are known to have been encountered.

i. Normal Operational Procedures - The low level outlets are normally closed and water is allowed to spill over the service spillway. Under drought conditions, or in the event of problems with the gravel-packed well water supply, the low level outlets may be opened and the reservoir content allowed to flow into the downstream Cox Reservoir. Thus, no operational procedures exist other than regular checking.

1.3 PERTINENT DATA

a. Drainage Area - 0.65 square miles of moderately steep, undeveloped terrain which is virtually 100% wooded.

b. Discharge at Dam Site - Discharge is from a reinforced concrete overflow service spillway and from an earthen overflow emergency spillway at higher flows. Elevations are in feet and are referenced to an assumed datum as shown on the design drawings. (Normal pool elevation 102.5 is approximate elevation 1,130 - 1,140 feet NGVD).

1. Outlet Works (conduits) capacity at top of dam el. 108:

| | <u>4"</u> | <u>8"</u> |
|--|-----------|-----------|
|--|-----------|-----------|

Two cast iron low level drains,
4" and 8" @ invert el. 80
(normally closed):

1 cfs 9 cfs

2. Maximum known flood at dam site:

N/A N/A

| | <u>Service</u> | <u>Emergency</u> |
|--|----------------|------------------|
|--|----------------|------------------|

3. Ungated spillway capacity at top of dam el. 108:

300 cfs 1,100 cfs

4. Ungated spillway capacity at test flood el. 105.7:

130 cfs 190 cfs

5. Gated spillway capacity at normal pool el. 102.5:

N/A N/A

6. Gated spillway capacity at test flood el. 105.7:

N/A N/A

7. Total spillway capacity at test flood el. 105.7:

130 cfs 190 cfs

The earthen emergency spillway has a crest elevation of about 104.5 and a crest length of about 60 feet. The spillway has side slopes of 3 horizontal to 1 vertical, and curves to intersect the original brook bed some 100 feet from the dam toe.

Two valved low level outlets, 4 inches and 8 inches in diameter penetrate the dam at its approximate center with the upstream inverts at about elevation 80. Valve boxes for these are on the downstream slope.

Elevations are referenced to an assumed datum as shown on the design drawings for the dam. (Normal pool elevation 102.5 is approximate elevation 1,130 - 1,140 feet NGVD).

No instrumentation exists at this dam.

c. Size Classification - SMALL - The dam impounds 114 acre-feet of water with the pond level at the top of the dam, which at elevation 108 (assumed datum) is 33 feet above the original streambed. With storage between 50 acre-feet and 1000 acre-feet and height between 25 feet and 40 feet, the dam falls into the small category of both criteria and is thus classified small in size according to the Recommended Guidelines.

d. Hazard Classification - SIGNIFICANT - If the dam were breached, there is potential for considerable property damage and loss of no more than a few lives. Three light duty roads between the dam and Cox District Reservoir Dam about 4600 feet downstream would be inundated by the pre-failure flow and further submerged by the breach outflow. The flood wave would overtop the Cox Reservoir Dam by about 7 feet, flooding two downstream residences to a depth of 3 or 4 feet, endangering a few lives. Overtopping of this magnitude would likely induce failure of the Cox Reservoir, increasing downstream flooding depth.

e. Ownership - Woodstock Aqueduct Company
East Woodstock, Vermont 05091
(802) 457-3040

Owner Contact:
Mr. Robert W. Hazen, V.P.
Dana Insurance Agency
9 Central Street
Woodstock, Vermont 05091
(802) 457-1422

The dam was built by its present owner.

f. Operator - Mr. Avery Colston
Woodstock Aqueduct Company
East Woodstock, Vermont 05091
(802) 457-3040

PHASE I INSPECTION REPORT

VONDELL RESERVOIR DAM

SECTION 1 - PROJECT INFORMATION

7

1.1 GENERAL

a. Authority - Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. James W. Sewall Company has been retained by the New England Division to inspect and report on selected dams in the State of Vermont. Authorization and notice to proceed were issued to James W. Sewall Company under a letter of April 2, 1980 from William E. Hodgson, Jr. Colonel, Corps of Engineers. Contract No. DACW 33-80-C-0051 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program - The purposes of the program are to:

1. Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.
2. Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.
3. To update, verify and complete the National Inventory of Dams.

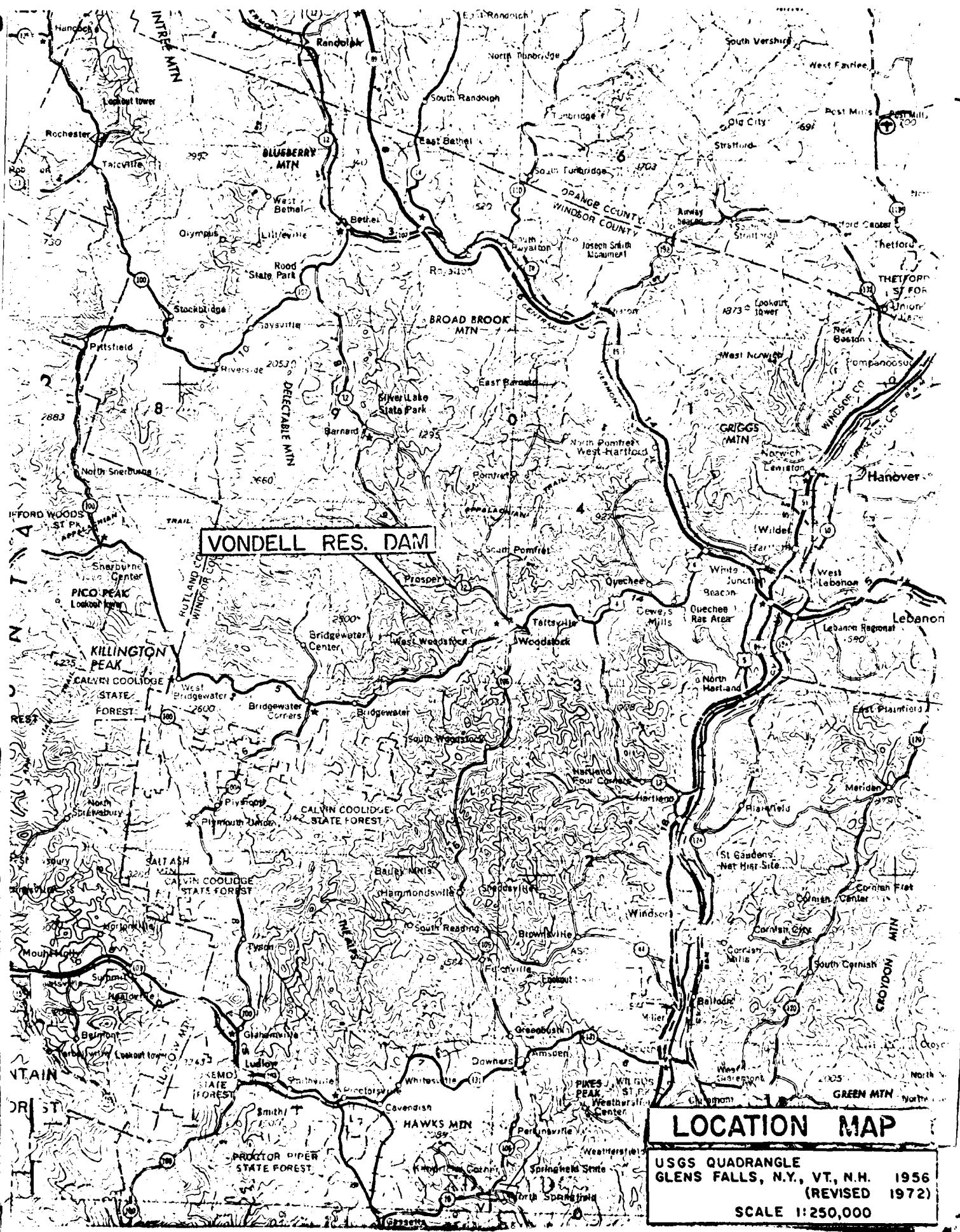
1.2 DESCRIPTION OF PROJECT

a. Location - The dam is located on the headwaters of Vondell Brook about 2.5 miles upstream from its confluence with the Ottauquechee River in a rural area of the Town of Woodstock, County of Windsor, State of Vermont. The dam is shown on the Woodstock North 7.5 minute USGS Quadrangle Map having coordinates latitude N 43° 37.7' and longitude W 72° 34.3'.

b. Description of Dam and Appurtenances - The dam, constructed in 1962, is a zoned earthfill embankment having a total length of approximately 580 feet. A 7 foot long reinforced concrete overflow service spillway exists near the left end of the dam, and an emergency earthen overflow spillway approximately 60 feet wide is cut into the left abutment.

The embankment has a top elevation of approximately 108, is 33 feet in height above the streambed and is 12 feet wide at the crest. The upstream slope is inclined at 3 horizontal to 1 vertical. The downstream slope is inclined at 2 horizontal to 1 vertical and is provided with a drainage blanket and toe drain system.

The structure containing the service spillway is a reinforced concrete box pentagonal in plan, four sides being at approximate elevation 107. The fifth side, the service spillway, has a crest length of approximately 7 feet at an elevation of about 102.5. The service spillway is ogee in cross-section. The service spillway outlet pipe is 54 inch reinforced concrete 192 feet long with the upstream invert at approximate elevation 97.





OVERVIEW PHOTO

| | | |
|---|---|--|
| U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | Vondell Reservoir Dam - VT 00160 Woodstock, Vermont April 22, 1980 |
| JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE | | |

5.5 DAM FAILURE ANALYSIS

Utilizing the April, 1978, "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs", the peak failure outflow with the pool initially at the top of the dam (el. 108 assumed datum) would be approximately 30,700 cfs. A breach of the dam would result in a rise in stage of 6.5 feet at a light duty road crossing about 3000 feet downstream which would further damage the road, submerged about 2 feet by the pre-failure flow. Further downstream, about 4500 feet below the dam, a light duty town road, overtopped 2.5 feet by the pre-failure flow, would be further damaged by a sudden 3 foot increase in stage. A third light duty roadway about 4600 feet from the dam and immediately upstream from Cox Reservoir, overtopped about 4.5 feet by the pre-failure flow, would be flooded 2 feet deeper by the breach. A 1979 Phase I Inspection Report for Cox District Reservoir Dam VT 00234, indicates the Cox Dam would be overtopped 0.6 feet by a test flood of 550 cfs. The routed Vondell Dam failure flow of 8100 cfs would cause overtopping of the Cox dam, by about 7 feet, and downstream flooding of two residences to a depth of 3 or 4 feet and a possible loss of lives. This magnitude of overtopping would likely fail the Cox dam, increasing the magnitude of downstream flooding. Because of the potential for loss of a few lives and the considerable downstream damage which would ensue from a breach (primarily downstream of Cox Dam), Vondell Reservoir Dam is classified as a "Significant Hazard" dam.

SECTION 6: EVALUATION OF STRUCTURAL STABILITY

6.1 VISUAL OBSERVATION

The visual inspection did not disclose any immediate stability problems; however, the following potential structural concerns were noted:

1. The trench excavated at the downstream toe of the dam could result in seepage conditions leading to internal erosion of the dam if the trench is allowed to remain open.
2. Ruts on the slopes and crest of the dam and on the right training wall of the emergency spillway are potential sources of erosion due to surface runoff.
3. The roots of the trees growing on the right training wall of the emergency spillway could lead to internal erosion of the dam if continued growth of the trees is permitted.
4. Trees and bushes growing in and overhanging the spillway and outlet channels could restrict the flow of water discharged into the channels.
5. Continued cracking and spalling of the concrete of the inlet structure could endanger its stability.
6. Location of the valve boxes on the downstream slope indicates a pressure conduit condition through the impermeable core of the dam, an undesirable and potentially hazardous situation as there would be no way to control a pipeline leak occurring within the dam.

6.2 DESIGN AND CONSTRUCTION DATA

No original design and construction data are available for the dam.

6.3 POST-CONSTRUCTION CHANGES

The trench at the downstream toe of the dam was excavated after the construction of the dam.

6.4 SEISMIC STABILITY

The dam is located in Seismic Zone 2, and in accordance with the recommended Phase 1 guidelines does not warrant seismic investigation.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Condition - Based upon the visual inspection, the dam is judged to be in good condition.

b. Adequacy of Information - Due to the lack of design and construction data for this dam, the assessment of safety is based solely on the visual inspection.

c. Urgency - The remedial measures and recommendations presented below should be implemented by the owner within 1 year after receipt of this Phase I Inspection Report, except as noted in Section 7.3.

7.2 RECOMMENDATIONS

The owner should engage a qualified registered engineer to provide technical assistance as follows:

a. Investigate the causes of concrete cracking on the inlet structure and to design corrective measures.

b. Design a means whereby the pressure conduit through the dam core may be eliminated.

c. Supervise removal of trees within 25 feet of the toe of the dam and the backfilling of areas thus excavated with suitable material.

d. Inspect the emergency spillway for evidence of erosion annually, and following each major discharge event.

The owner should implement all recommendations by the engineer.

7.3 REMEDIAL MEASURES

a. The trench excavated at the downstream toe of the dam should be back-filled with the excavated material upon receipt of the report by the owner. The material should be placed and compacted in lifts.

b. The ruts on the slopes and crest of the dam and on the right wing wall of the emergency spillway should be backfilled and the areas reseeded, upon receipt of the report by the owner. Formation of ruts should be avoided in the future.

c. Bush and tree growth on the embankment and within 25 feet of the downstream toe should be cut, and new growth cut every two years.

d. A program of annual technical inspection, with repairs as necessary, should be instituted by the owner.

e. A formal downstream warning system to be implemented in the event of an emergency at the dam should be developed by the owner.

f. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

7.4 ALTERNATIVES

This study has identified no practical alternative to the above recommendations.

APPENDIX A
VISUAL CHECK LIST WITH COMMENTS

VISUAL INSPECTION CHECKLIST PARTY ORGANIZATION

PROJECT Varieté Rosalie Dam

DATE Apr. 5 '70

TIME - 4:45

WEATHER Hot rainy

W.S. ELEV. _____ U.S. _____ DN.S. _____

PARTY:

| | | |
|--------|---------------------------------|--|
| J. S. | 1. Stephen J. Murray S.D.M. | 6. A. Peter Barrance VI. Water Resources |
| J.W.S. | 2. Poetry L. Hanscom R.L.H. | 7. _____ |
| C. S. | 3. Christopher A. Finner C.A.F. | 8. _____ |
| G.I. | 4. Daniel Z Lo Gatta D.P.L. | 9. _____ |
| G.E.I. | 5. Stephen L. Hineside S.L.H. | 10. _____ |

PROJECT FEATURE

INSPECTED BY

REMARKS

1. Dam Environment D.P.L. S.L.I.U. S.D.M. R.L.H. C.A.H.
2. In-situ Structure D.P.L. S.L.I.U. S.D.M. R.L.H. C.A.H.
3. Outlet Structure & Outlet Channel D.P.L. S.L.I.U. S.D.M. R.L.H. C.A.H.
4. Emergency Spillway & Discharge Channel D.P.L. S.L.I.U. S.D.M. R.L.H. C.A.H.
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

PERIODIC INSPECTION CHECKLIST

| PROJECT <u>Brown Reservoir Dam</u> | DATE <u>Aug. 5, 1970</u> |
|---|--|
| PROJECT FEATURE <u>Dam Embankment</u> | NAME _____ |
| DISCIPLINE <u>Geotechnical Services</u> <u>Geotechnical Engineers Inc.</u> | NAME <u>S.L.V., P.L.T., C.P.H.</u> <u>D.P.L., S.L.V.</u> |
| AREA EVALUATED | CONDITION |
| <u>DAM EMBANKMENT</u> | |
| Crest Elevation | None observed |
| Current Pool Elevation | No pavement |
| Maximum Impoundment to Date | None observed |
| Surface Cracks | None observed |
| Pavement Condition | None observed |
| Movement or Settlement of Crest | None observed |
| Lateral Movement | None observed |
| Vertical Alignment | No misalignment observed |
| Horizontal Alignment | No misalignment observed |
| Condition at Abutment and at Concrete Structures | Erosion next to left wall of spillway intake structure. |
| Indications of Movement of Structural Items on Slopes | None observed |
| Trespassing on Slopes | Vehicle tracks on crest and downstream slope |
| Sloughing or Erosion of Slopes or Abutments | None observed |
| Rock Slope Protection - Riprap Failures | No riprap observed |
| Unusual Movement or Cracking at or Near Toe | 110 ft long trench has been excavated at downstream toe from about Sta. 4+20 to Sta. 5+30. Water seeping into trench at about STA. 5+30. Ground upstream of the trench at STA. 5+30 is wet and soggy. |
| Unusual Embankment or Downstream Seepage | None observed Bare toe drain with 6in. outlet pipe |
| Piping or Boils | None observed |
| Foundation Drainage Features | None observed |
| Toe Drains | See above |
| Instrumentation System | None observed |
| Vegetation | Gross has been recently cut on crest and upstream and downstream slopes |

PERIODIC INSPECTION CHECKLIST

PROJECT Kearny Reservoir DamDATE Aug. 5, 1980

PROJECT FEATURE _____

NAME _____

DISCIPLINE Geotechnical Co.
Geotechnical Engineers Inc.NAME S.D.M., P.L.H., C.E.H.
D.P.L., S.L.V.

| AREA EVALUATED | CONDITION |
|---|---|
| <u>DIKE EMBANKMENT</u> | <u>There is no dike on this project</u> |
| Crest Elevation | |
| Current Pool Elevation | |
| Maximum Impoundment to Date | |
| Surface Cracks | |
| Pavement Condition | |
| Movement or Settlement of Crest | |
| Lateral Movement | |
| Vertical Alignment | |
| Horizontal Alignment | |
| Condition at Abutment and at Concrete Structures | |
| Indications of Movement of Structural Items on Slopes | |
| Trespassing on Slopes | |
| Sloughing or Erosion of Slopes or Abutments | |
| Rock Slope Protection - Riprap Failures | |
| Unusual Movement or Cracking at or Near Toes | |
| Unusual Embankment or Downstream Seepage | |
| Piping or Boils | |
| Foundation Drainage Features | |
| Toe Drains | |
| Instrumentation System | |
| Vegetation | |

4
PROJECT Kennebec Reservoir Dam

DATE Aug. 5, 1980

PROJECT FEATURE Intake Structure

NAME _____

DISCIPLINE James S. L. Co.

NAME S.D.M., P.L., C.E.H.

Geotechnical Engineers Inc.

D.P.L. S.L.V.

| AREA EVALUATED | CONDITION |
|---|--|
| <u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u> a. Approach Channel Slope Conditions Bottom Conditions Rock Slides or Falls Log Boom Debris Condition of Concrete Lining Drains or Weep Holes | Under water - not observed |
| b. Intake Structure Condition of Concrete Stop Logs and Slots | Concrete is in fair condition with minor cracks and efflorescence. Top of riprap area under steel plate has worn off. Is to be repaired. |

PERIODIC INSPECTION CHECKLIST

PROJECT Vogelii Reservoir DamDATE Aug. 5, 1980

PROJECT FEATURE _____

NAME _____

DISCIPLINE Jesse H. Sewall Co.
Geotechnical Engineers Inc.NAME C.D.W. Burch C.A.H.
D.P.L., S.L.T.

| AREA EVALUATED | CONDITION |
|--|----------------------------------|
| <u>OUTLET WORKS - CONTROL TOWER</u> | <u>There is no control tower</u> |
| a. Concrete and Structural | |
| General Condition | |
| Condition of Joints | |
| Spalling | |
| Visible Reinforcing | |
| Rusting or Staining of Concrete | |
| Any Seepage or Efflorescence | |
| Joint Alignment | |
| Unusual Seepage or Leaks in Gate Chamber | |
| Cracks | |
| Rusting or Corrosion of Steel | |
| b. Mechanical and Electrical | |
| Air Vents | |
| Float Wells | |
| Crane Hoist | |
| Elevator | |
| Hydraulic System | |
| Service Gates | |
| Emergency Gates | |
| Lightning Protection System | |
| Emergency Power System | |
| Wiring and Lighting System | |

PERIODIC INSPECTION CHECKLIST

6

PROJECT Vandad Reservoir DamDATE Aug. 5 1980

PROJECT FEATURE _____

NAME _____

DISCIPLINE James L. Selby Co.
Geotechnical Engineers Inc.NAME S.D.A. P.L.H. C.A.T.
D.P.L. S.L.M.

| AREA EVALUATED | CONDITION |
|---|----------------------|
| <u>OUTLET WORKS - TRANSITION AND CONDUIT</u> General Condition of Concrete Rust or Staining on Concrete Spalling Erosion or Cavitation Cracking Alignment of Monoliths Alignment of Joints Numbering of Monoliths | <u>See next page</u> |

PERIODIC INSPECTION CHECKLIST

PROJECT Kenne River Dam DATE Aug. 5, 1980

PROJECT FEATURE Outlet Structure & Outlet Channel NAME _____

DISCIPLINE James H. Seward Co. NAME S.D.M. P.L.L.C. C.A.T.
GeoTechnica Engineers Inc. D.P.L. S.L.V.

| AREA EVALUATED | CONDITION |
|---|---|
| <u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u> | The outlet structure is a 36" F.O. pipe, leading from the intake structure to the original brook course at the lower end of the emergency spillway. |
| General Condition of Concrete | The pipe is in good condition. |
| Rust or Staining | None observed. |
| Spalling | None observed. |
| Erosion or Cavitation | None observed. |
| Visible Reinforcing | None observed. |
| Any Seepage or Efflorescence | None observed. |
| Condition at Joints | Good, no misalignment |
| Drain holes | None observed |
| Channel | Brush growing in channel at discharge pipe and downstream of discharge pipe |
| Loose Rock or Trees Overhanging Channel | Fair |
| Condition of Discharge Channel | |

PERIODIC INSPECTION CHECKLIST

PROJECT Vorone Reservoir DamDATE Aug. 5, 1970PROJECT FEATURE Emergency Spillway and Discharge Channel

NAME _____

DISCIPLINE James W. Scott Co.
Geotechnical Engineers Inc.NAME G.D.W. R.L.H. C.E.T.
D.P.L. S.L.W.

| AREA EVALUATED | CONDITION |
|--|--|
| <u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u> | |
| a. Approach Channel | Not observed - under water |
| General Condition | |
| Loose Rock Overhanging Channel | |
| Trees Overhanging Channel | |
| Floor of Approach Channel | |
| b. Weir and Training Walls | Training wall is earth embankment |
| General Condition of Concrete | |
| Rust or Staining | |
| Spalling | |
| Any Visible Reinforcing | |
| Any Seepage or Efflorescence | |
| Drain Holes | None observed |
| c. Discharge Channel | |
| General Condition | Good |
| Loose Rock Overhanging Channel | None observed |
| Trees Overhanging Channel | None observed |
| Floor of Channel | Grass covered until end of discharge channel where numerous trees and bushes are growing. |
| Other Obstructions | |
| Other Comments | Paint training wall for channel is grass covered. Motorcycle ruts have been created in wall. |

PERIODIC INSPECTION CHECK LIST

| PROJECT <u>Varanasi Barrage Dam</u> | DATE <u>Aug. 5, 1970</u> |
|---|---|
| PROJECT FEATURE _____ | NAME _____ |
| DISCIPLINE <u>James L. Sauer Co., Geotechnical Engineers Inc.</u> | NAME <u>S.D.M., P.L.E., C.A.T. D.P.L., S.L.I.C.</u> |
| AREA EVALUATED | CONDITION |
| OUTLET WORKS - SERVICE BRIDGE | |
| a. Super Structure | There is no service bridge |
| Bearings | |
| Anchor Bolts | |
| Bridge Seat | |
| Longitudinal Members | |
| Underside of Deck | |
| Secondary Bracing | |
| Deck | |
| Drainage System | |
| Railings | |
| Expansion Joints | |
| Paint | |
| b. Abutment & Piers | |
| General Condition of Concrete | |
| Alignment of Abutment | |
| Approach to Bridge | |
| Condition of Seat & Backwall | |

WOODSTOCK AQUEDUCT COMPANY
WOODSTOCK VERMONT

EDWARD G. WELCHMAN, PRESIDENT
GEORGE C. BROCKWAY, VICE PRES.
F. S. BILLINGS, JR. SECRETARY

March 5, 1962

Water Conservation Board
State of Vermont
State Office Building
Montpelier, Vermont

Dear Sirs:

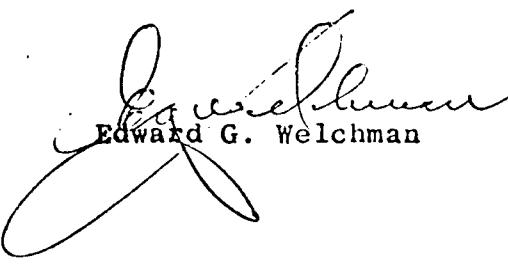
We enclose our application for the Construction Permit for a Dam with a copy of the letter which we sent to the Selectmen.

Through the drought that Woodstock had last summer it is imperative, as soon as we can start in the spring, to let out this contract in order to procure additional water facilities. Therefore, our plea to hold your Hearing as soon as possible in order to help us expedite the rendering of this contract.

Your cooperation in this matter will be greatly appreciated, and thanking you, remain

Yours very truly,

Woodstock Aqueduct Company,


Edward G. Welchman

EGW:FM

| ROUTING | | |
|---------|-------|------|
| GENERAL | | |
| TO | REC'D | DATE |
| JEC | JLC | 3-7 |
| RWT | R | 3-23 |
| 30 | | B-13 |
| 100 | | |

INVITATION TO BID

April 23, 1962

Sealed Proposal addressed to The Woodstock Aqueduct Company, Woodstock, Vermont covering the work required for construction of the Vendell Reservoir dam with associated structures, together with a bid bond in the amount of five percent of the total bid, will be received at the office of the corporation in Woodstock, Vermont until 2:30 P.M. on May 16, 1962 and at that time and place will be publicly opened and read aloud.

The project consists of construction of a rolled earthfill dam requiring approximately 23,000 cubic yards of earthfill, 166 feet of 8" cast iron pipe, 210 feet of 54" diameter reinforced concrete pipe for a service spillway, together with such other work as stripping, clearing, excavating, concrete work, valves, and other items to result in a complete operating dam as shown on the drawings.

Contract Documents, specifications, and plans for the proposed work may be examined at the office of The Gratiot Engineering Company, 39 Central Street, Woodstock, Vermont and at the office of the F. W. Dodge Corporation in Manchester, New Hampshire. Copies of these Documents may be obtained from The Gratiot Engineering Company upon payment of ten dollars (\$10.00) for each set. This deposit will be refunded if the Documents are returned in good condition within five days after the opening of bids.

THE GRATIOT ENGINEERING COMPANY

J. Peter Gratiot

June 5, 1962

Mr. Franklin S. Billings, Jr.
Attorney at Law
The Green
Woodstock, Vermont

Dear Bill:

Agreeable to our previous discussions, this office has reviewed a set of plans and specifications for the Vondell Dam and Reservoir as submitted on May 15, 1962. These plans and specifications were found to contain the additions and corrections that were requested by this office. Accordingly, we have stamped this set of drawings and specifications as "Approved", thereby making them the official set for the construction of this project. Should the engineer find it desirable or necessary to deviate from these plans and specifications, proper clearance in writing should be obtained from this office before such changes are made a part of the project.

With best wishes, I am,

Sincerely,

Reinhold W. Thieme, P. E.
Commissioner of Water Resources

RWT:mls
Enc. 1 set plans
1 " specifications

| ROUTING | | |
|------------|-------|------|
| GENERAL | | |
| TO | NOTED | DATE |
| RWT | P. | 6-5 |
| | f.c | 6-5 |
| SUSPEND TO | | |
| FILE | | |

SPECIFICATIONS AND DRAWINGS

VOLDFILL R. RESERVOIR
WOODSTOCK AQUEDUCT COMPANY

CHANGE ORDER #1

SEP 4 1962

1. This change order covers additions and changes to the drawings and specifications. The service spillway conduit has been shortened by two eight foot lengths at the downstream end and the spillway structure supported on a slab footing rather than on ledge, since no ledge was encountered on excavation for the footing.

2. Drawings:

a) Drawing D-1

Change list of drawings to read:

| | | |
|---------|--|--------|
| No. D-1 | Title Page | Rev. C |
| D-2 | Existing Site Plan and Test Hole Data | Rev. A |
| D-3 | General Arrangement | Rev. J |
| D-4 | Stripped Foundation Plan | Rev. F |
| D-5 | Outlet Works Details | Rev. F |
| D-6 | Service Spillway Details | Rev. D |
| D-7 | Miscellaneous Details | Rev. E |

b) Drawing D-3

Revisions G, H & J supersede revision F.

c) Drawing D-6

Revisions C & D supersede revision B

d) Drawing D-7

Revision E supersede revision D

3. Specifications:

a) Addendum No. 1

Change item 8 (a) to read:

Length of spillway 54" pipe is changed from 208 feet or 26 eight foot lengths of 54" pipe to 192 feet or 24 eight foot lengths of 54" pipe.

b) Form of Agreement:

Article I (a). Change the list of drawing revisions to agree with item 2 above.

P. 1 of 1

| |
|---------------------------|
| VERIFIED AND APPROVED FOR |
| APPROVED |
| SEP - 6 1962 |
| R.W. Thorne |

THE GRATIOT ENGINEERING COMPANY
CONSULTING ENGINEERS
39 CENTRAL STREET - WOODSTOCK, VERMONT
TELEPHONE 180 & 815

| ROUTING | | |
|-------------------|-------|------|
| GENERAL | | |
| TO | NOTED | DATE |
| JEC | JCC | 9-5 |
| DW | | 7-5 |
| RWT | | |
| September 4, 1962 | | |
| PENDING TO | | |
| FILE | | |

September 4,

Water Resources Board
State Office Building
Montpelier, Vermont

ATTENTION: Mr. Reinhold Thieme, Commissioner

Re: Vondell Reservoir
Woodstock Aqueduct Co.
Change Order #1

Gentlemen:

We attach description and one set of drawings affected by this change on subject job.

The change in length of the service spillway as resulted from a recent field check of the profile. Installation of the slab footing under this spillway inlet was made necessary by failure to find ledge as expected.

We respectfully request that the change shown be approved by your office as modification to the original approved set of documents.

Very truly yours,

THE GRATIOT ENGINEERING COMPANY

J. Peter Gratiot, P.E.

JPG:jj

cc: Woodstock Aqueduct Company

attachment

September 6, 1962

J. Peter Gratiot, P. E.
The Gratiot Engineering Company
39 Central Street
Woodstock, Vermont

Re: Vondell Reservoir
Woodstock Aqueduct Co.
Change Order #1

Dear Mr. Gratiot:

Your letter of September 4th enclosing a description and one set of drawings affected by the change on the referenced job is hereby acknowledged.

Mr. Cerutti, Hydraulic Engineer for this office, has reviewed this Change Order and advises me that the changes are satisfactory.

Approval of this office is hereby given for Change Order #1 on the referenced project, said change as described in your letter of September 4th and as shown on the modified drawings furnished therewith. May I suggest that an additional copy of the specification or description and a set of drawings be sent to this office so that they might be stamped "approved" and become part of the record of the Woodstock Aqueduct Company.

Sincerely,

Reinhold W. Thieme, P. E.
Commissioner of Water Resources

RWT:ms

| ROUTING | | |
|------------|-------|------|
| GENERAL | | |
| TO | NOTED | DATE |
| RWT | R. | 9-6 |
| JEC | JEC | 9-6 |
| SUSPEND TO | | |

B-8

THE GRATIOT ENGINEERING COMPANY
CONSULTING ENGINEERS
39 CENTRAL STREET • WOODSTOCK, VERMONT

NOLED 1-14
SEC REC 1-14
RWT \$ 1-14

January 10, 1963

HOHOU0238 RETAW 70.1963

Mr. Edward G. Welchman, President
The Woodstock Aqueduct Company
Woodstock, Vermont

Re: Vondell Reservoir

Dear Ed:

This morning Mr. Hazen, Mr. Pumpelly and I visited the Vondell dam to check it for settlement. On November 29, 1962 we had set five pipes along the top of the dam to use as reference points.

This morning's measurements indicate that the earth, where exposed through snow, and the pipes have moved upward approximately 1".

We consider the above increase in ground height consistent with the fact that all but the top few feet of the dam were placed with a degree of compaction in excess of that normally obtained (and in excess of what we specified) with the result that there is apparently no actual settlement but only a small amount of frost heave showing up.

We have discussed this matter with Mr. Cerutti of the Department of Water Resources and he and I are in agreement that it will be entirely in order to start impounding some water behind the dam.

Since the top foot of fill has not been placed on the dam you should not permit the dam to fill to normal spillway height and it is recommended that the water level be maintained at about $\frac{1}{2}$ to $\frac{3}{4}$ of the design depth in order to allow some additional storage in the event of a severe storm.

Very truly yours,

THE GRATIOT ENGINEERING COMPANY

J. Peter Gratiot, P.E.

JPG:jj

cc: Water Resources Board

| ROUTING | | |
|---------|-------|------|
| GENERAL | | |
| TO | NOTED | DATE |
| JEC fc | | 4-16 |
| RWT R. | | 4-22 |
| DWD DWW | | 4-16 |

THE GRATIOT ENGINEERING COMPANY
CONSULTING ENGINEERS
39 CENTRAL STREET - WOODSTOCK, VERMONT
TELEPHONE 802 457-2300

RECORDED AND INDEXED APRIL 11, 1963

April 11, 1963

vs

Mr. Edward G. Welchman, President
The Woodstock Aqueduct Company
Woodstock, Vermont

Re: Vondell Reservoir

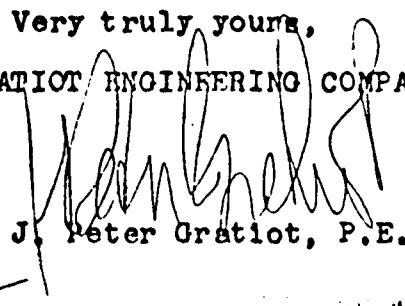
Dear Ed:

We have not heard anything from the Water Resources Board regarding our request for permission to raise the water level to spillway elevation.

Since making our verbal request to the Water Resources Board we have taken the transit up to the dam and have picked up some detail elevation data. It appears that there has been no significant settlement on the dam. We had driven some iron pipes about 4 feet into the earth on the back side of the crest at five places and those pipes show elevation changes from 1/10 foot of settlement at two locations to 1/10 foot of increase in elevation at two locations and substantially no change at the other. The dam appears to be in good condition but there is at station 4 plus 42 approximately a low point with an elevation only 2.6 feet above service spillway crest. This puts the top of the dam at this location at about the elevation of the water for our design flood condition. In my opinion it is not wise to let the water come up to the spillway elevation until Mr. Sailer has completed his earthwork on the top of the dam. Therefore, until such time as Mr. Sailer can complete his earthwork it is my recommendation that the water level be maintained at an elevation not higher than 3 feet below the service spillway elevation. When Mr. Sailer has completed his earthwork we can ask the State to make an inspection and at that time we can raise the water up to the spillway. In the meantime please keep sufficient outflow to balance the inflow and maintain the water level as indicated above.

Very truly yours,

THE GRATIOT ENGINEERING COMPANY



J. Peter Gratiot, P.E.

JPG:jj

cc: The Water Resources Board

THE GRATIOT ENGINEERING COMPANY
CONSULTING ENGINEERS
39 CENTRAL STREET • WOODSTOCK, VERMONT
TELEPHONE 802 457-2300

RWT 1P 10-29
JEC EC 10-29
DWW DWW 10-29

October 28, 1963

Water Resources Board
State Office Building
Montpelier, Vermont

Re: Certificate of Completion
Vondell Reservoir
Woodstock Aqueduct Company
Woodstock, Vermont

Gentlemen:

This is to inform you all work required in connection with the construction of subject reservoir has been completed as of this date and that all parts of this work have been executed in conformity with our designs and under our general supervision.

Very truly yours,
THE GRATIOT ENGINEERING COMPANY

J. Peter Gratiot, P.E.

JPG:js

cc: The Woodstock Aqueduct Company

VERMONT DEPARTMENT OF WATER RESOURCES

INFORMATION SHEET

Name of Dam Wardstock Aqueduct Co. Town Wardstock
 Owner Wardstock Aqueduct Co. Name of Stream Vermont Brook
Oleguechee River Trib.
 Address 9 Central St. Classification _____
Wardstock, Vt.

U.S.G.S. Coordinates: Lat. 43° 40' Long. 72° 25" 34-17" 3045
 U.S.G.S. Map Wardstock, Atch, Vt (36-c) Aerial Photos 17-62-14 47-148-149

U.S.G.S. Elev. @ Spillway _____

Total Length of Dam 580' Crest Width of Emergency 60'
 Spillway

Width of Top 12' Maximum Height 33'

Spillway Capacity: Principal _____ Emergency _____

Pond Area 62 acres Drainage Area .54 sq mi

Pond Volume: Normal Water Level 41 cu ft Design High Water Level _____

Maximum Water Depth: Normal Water Level _____ Design High Water 28'
 Level

Storage Before Emergency Spillway is Used _____

Use of Reservoir Water Supply

Description of Dam: Earth fill

Description of Spillway(s): P.S. Service Spillway Dye width 54" conc. pipe
 E.S. Vegetated

Designed by Project Eng. Co. Year Built '63

Hearing Date April 10, 1962 Order Date June 1, 1962

Additional Remarks:

SUMMARY OF DATA AND CORRESPONDENCE

| <u>DATE</u> | <u>TO</u> | <u>FROM</u> | <u>SUBJECT</u> | <u>PAGE</u> |
|-------------|----------------------------------|---|---|-------------|
| - | File | - | Vermont Department of Water Resources Information Sheet | B-4 |
| 10-28-63 | Water Resources Board | Gratiot Engineering Company | Certificate of Completion | B-5 |
| 4-11-63 | E. G. Welchman | Gratiot Engineering Company | Water level in reservoir | B-6 |
| 1-10-63 | E. G. Welchman | Gratiot Engineering Company | Water level in reservoir | B-7 |
| 9-6-62 | J. Peter Gratiot | R. W. Thieme Commissioner Water Resources | Approval of Change Order | B-8 |
| 9-4-62 | Water Resources Board | Gratiot Engineering Company | Change Order | B-9 |
| 6-5-62 | Franklin S. Billings | R. W. Thieme Commissioner | Approval of plans | B-11 |
| 4-23-62 | Public | Gratiot Engineering Company | Invitation to Bid | B-12 |
| 3-5-62 | Water Con- servation Board | Woodstock Aqueduct Company | Application for Permit | B-13 |
| 5-62 | - | - | Design Plans - Reduced in Size | B-14 |

VONDELL RESERVOIR DAM

EXISTING PLANS

On file with the Vermont Department of Water Resources:

1. Woodstock Aqueduct Co.

Vondell Reservoir

Gratiot Engineering Co., Woodstock, Vermont

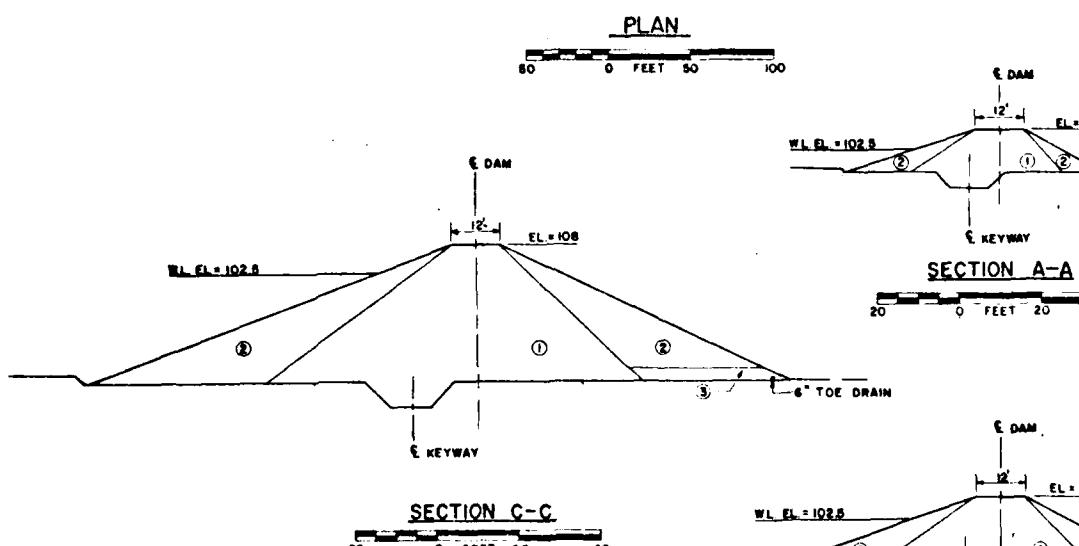
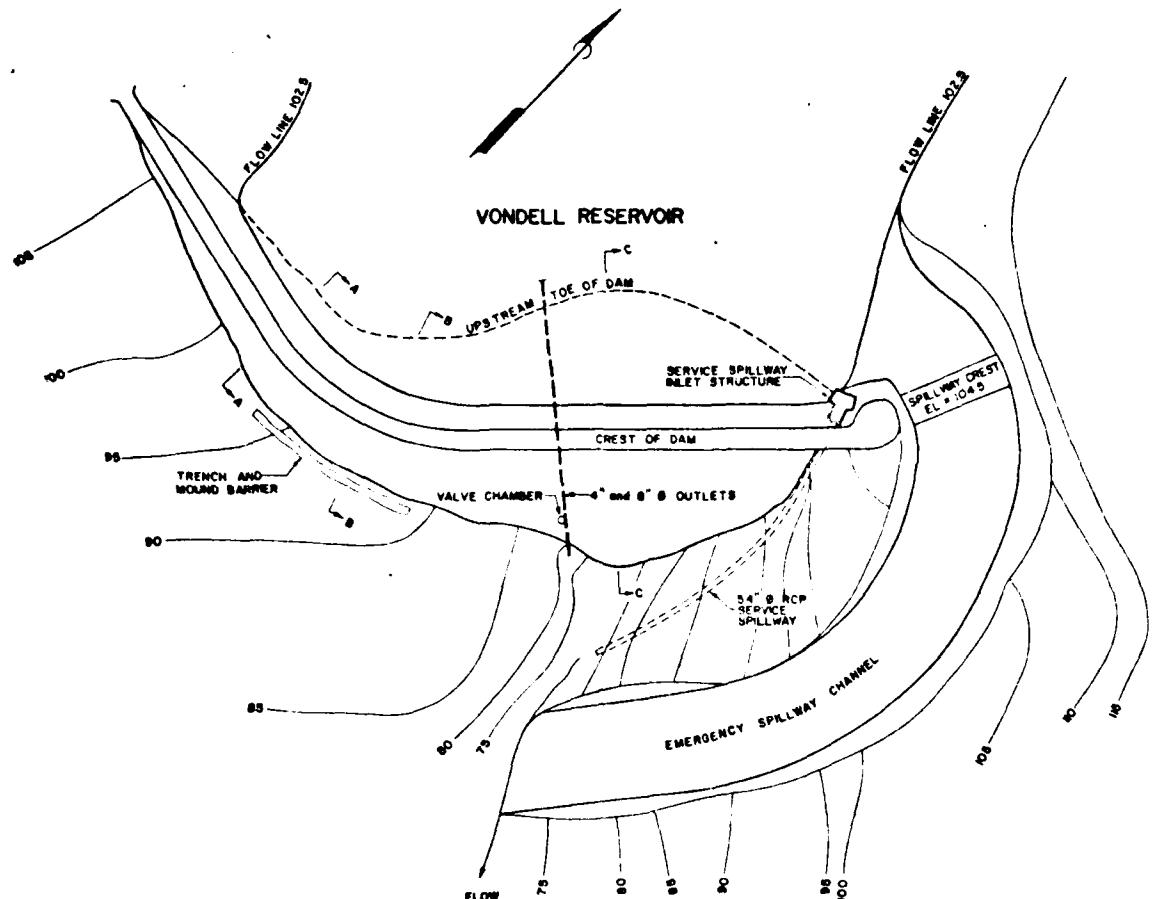
Dwg. D-3 General Arrangement, May, 1962

Dwg. D-4 Stripped Foundation Plan and Sections, May, 1962

Dwg. D-5 Outlet Works - Details, May, 1962

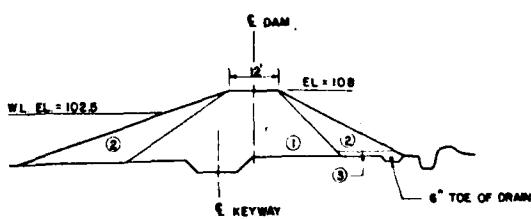
Dwg. D-6 Service Spillway Details, May, 1962

Dwg. D-7 Miscellaneous Details, May, 1962



NOTE:
THIS PLAN COMPILED FROM EXISTING PLANS
FOR DAM CONSTRUCTION, DRAWN BY THE
GRATIOT ENGINEERING CO. IN 1962, AND
MODIFIED AS OBSERVED IN THE FIELD

NOTE.
ZONE 1 — IMPERVIOUS
ZONE 2 — IMPERVIOUS IF AVAILABLE
ZONE 3 — SAND AND GRAVEL

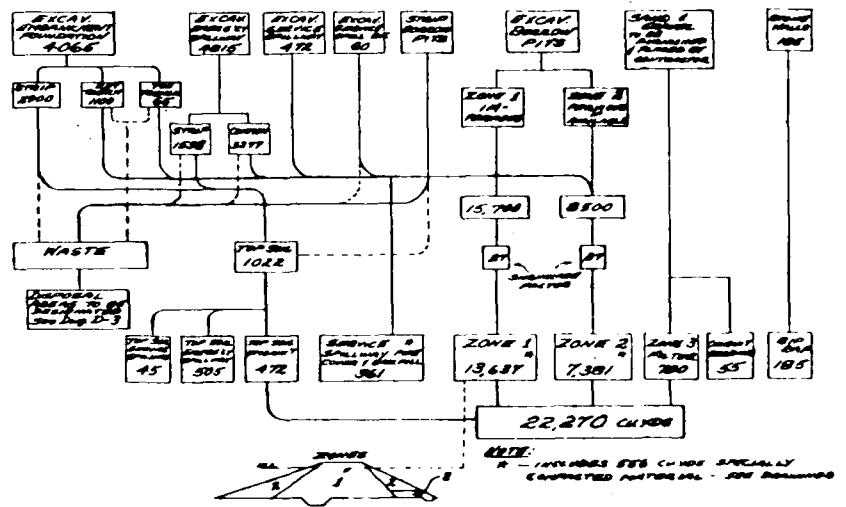


SECTION B-B

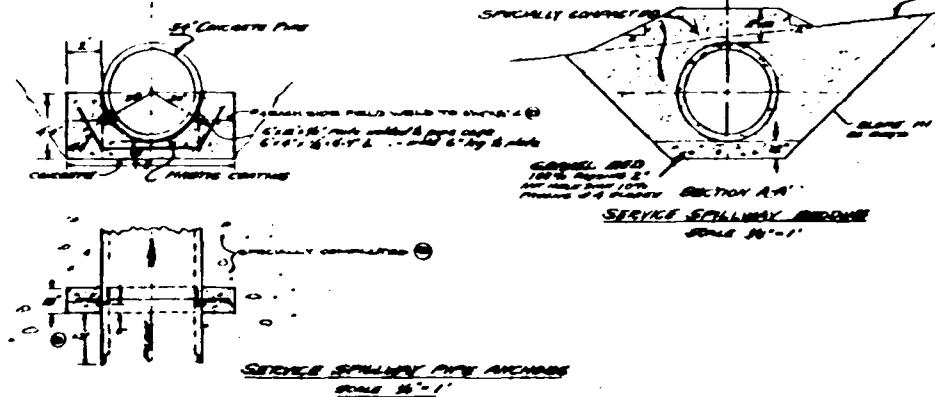
| | | | | | |
|--|----------|--|----|--|------|
| U. S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | | JAMES W SEWALL COMPANY CONSULTING ENGINEERS 147 Centre Street P.O. Box No. 24168 Tel: 701-827-4456 | | NATIONAL PROGRAM OF INSPECTION OF NON-FEDERAL DAMS VONDELL RESERVOIR WOODSTOCK, VT | |
| NO. | REVISION | DATE | CK | Approved | Date |

APPENDIX B
ENGINEERING DATA

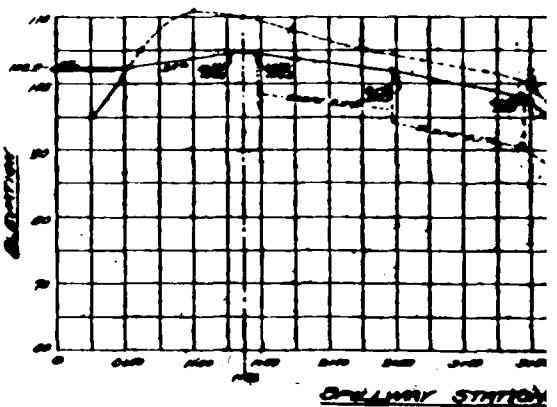
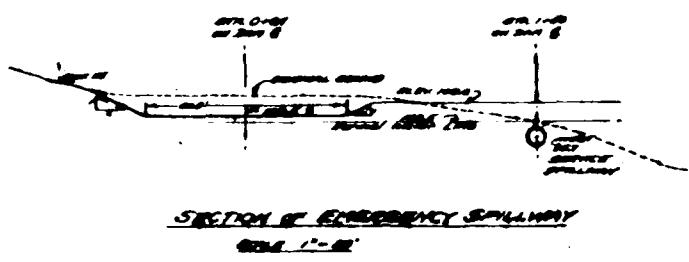
② MATERIALS DISTRIBUTION

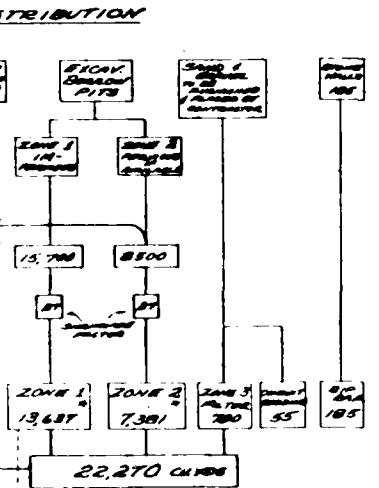


PROF.

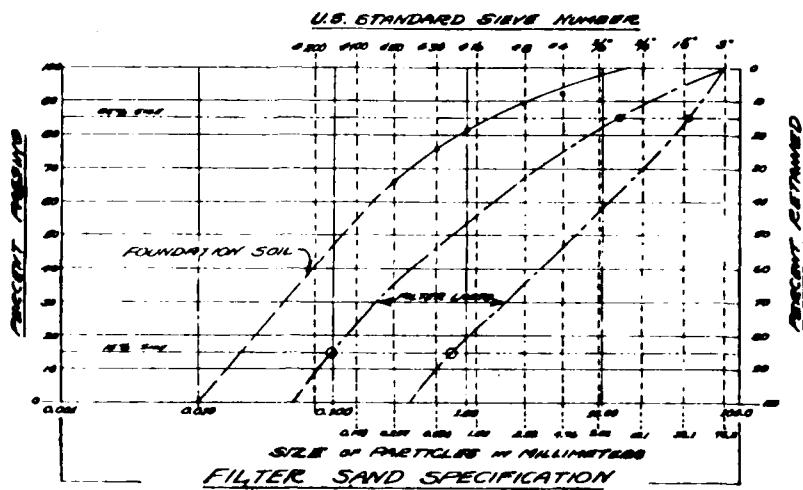


PROFILE OF EMERGENCY

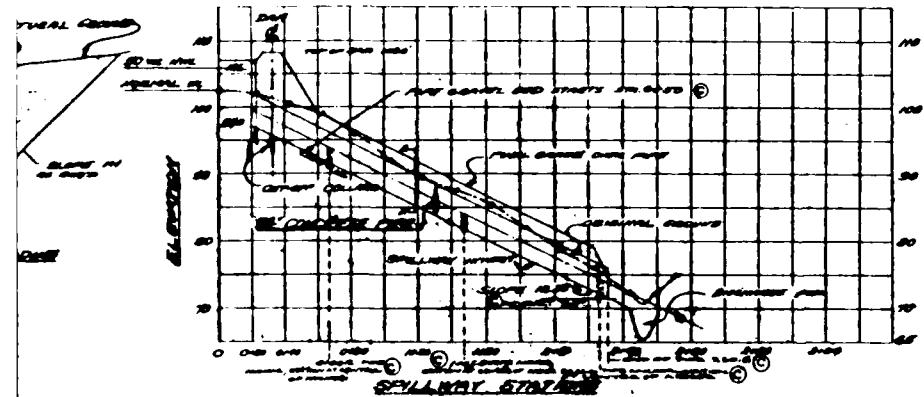




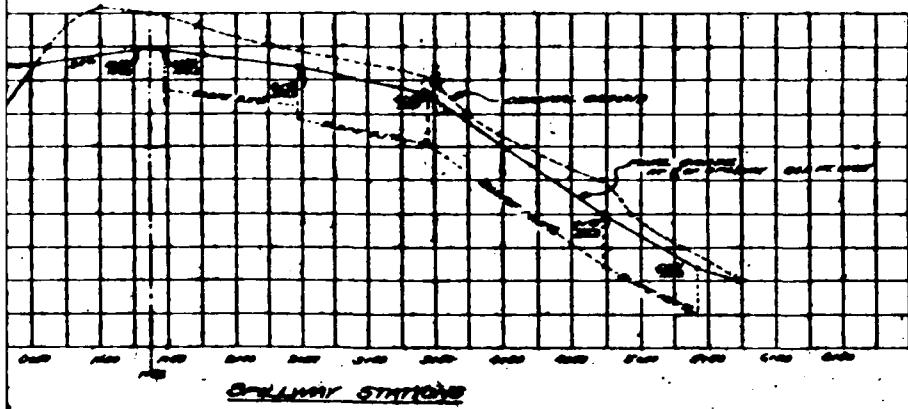
4-1 - **INTERFACES** **ARE** **NOT** **SPECIALLY**
DESIGNED **AMONG** **THE** **VARIOUS** **SYSTEMS**



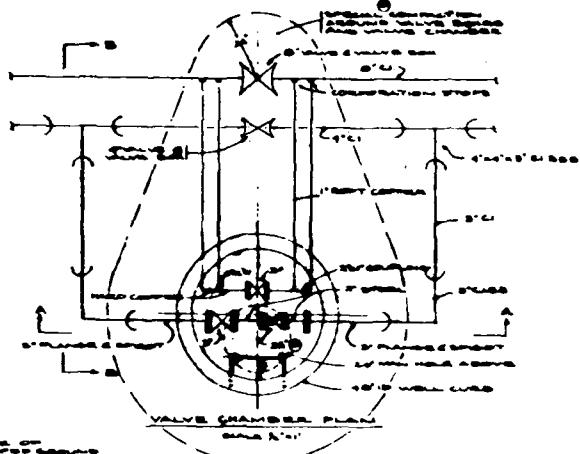
PROFILE OF SERVICE SPILLWAY



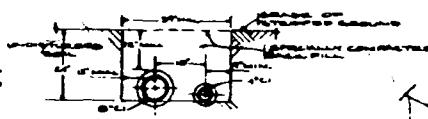
PROFILE OF EMERGENCY & SUMMARY



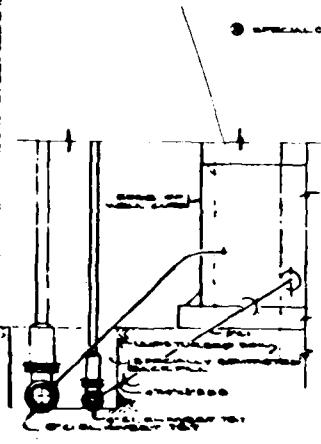
NOT TO SCALE



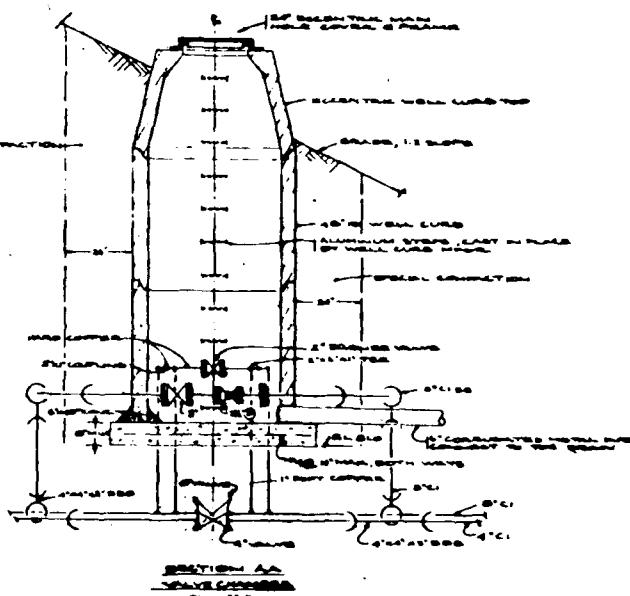
VALVE CHAMBER PLAN
Scale 1:1"



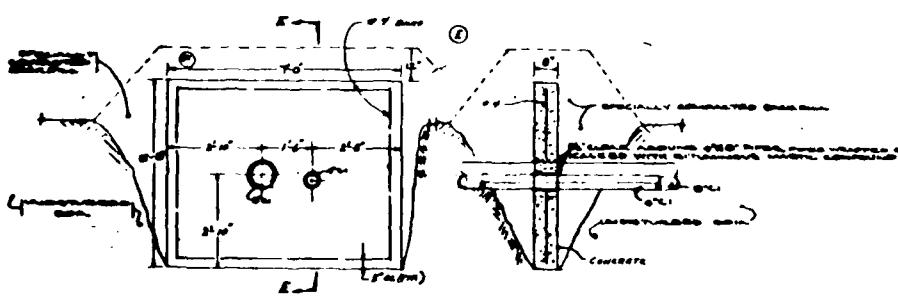
TRANSMISSION DETAILS



SECRET INFORMATION

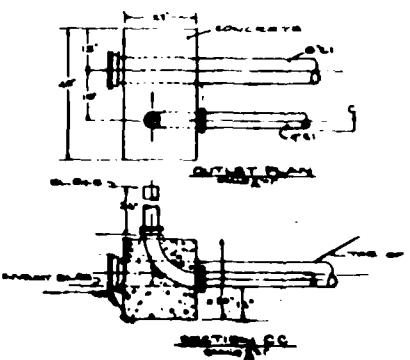


SECTION A
ANSWER SHEET

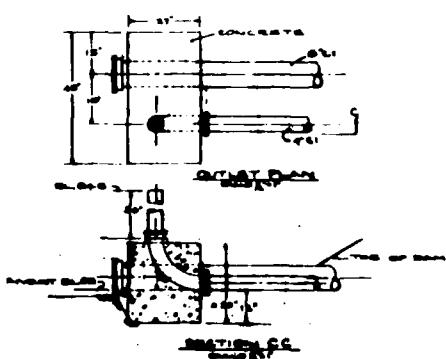
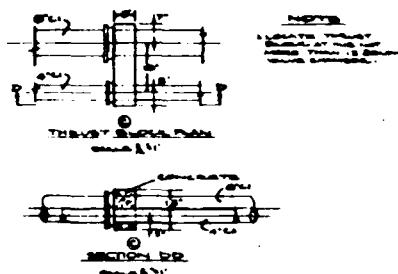
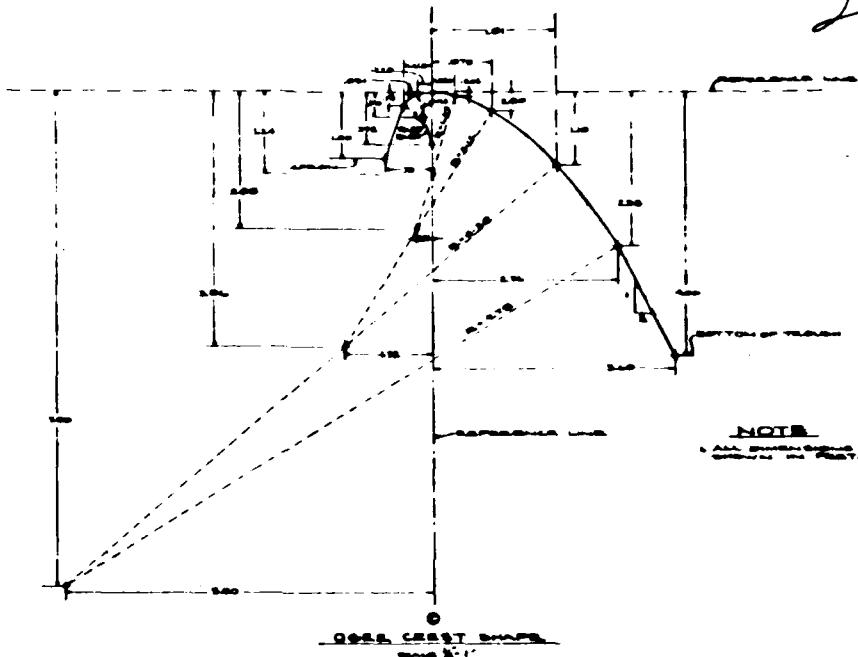


CUT-OFF COLLAR DETAIL
SCALE 1"-1"

SECRET//NOFORN E-E
some 5' - 1'

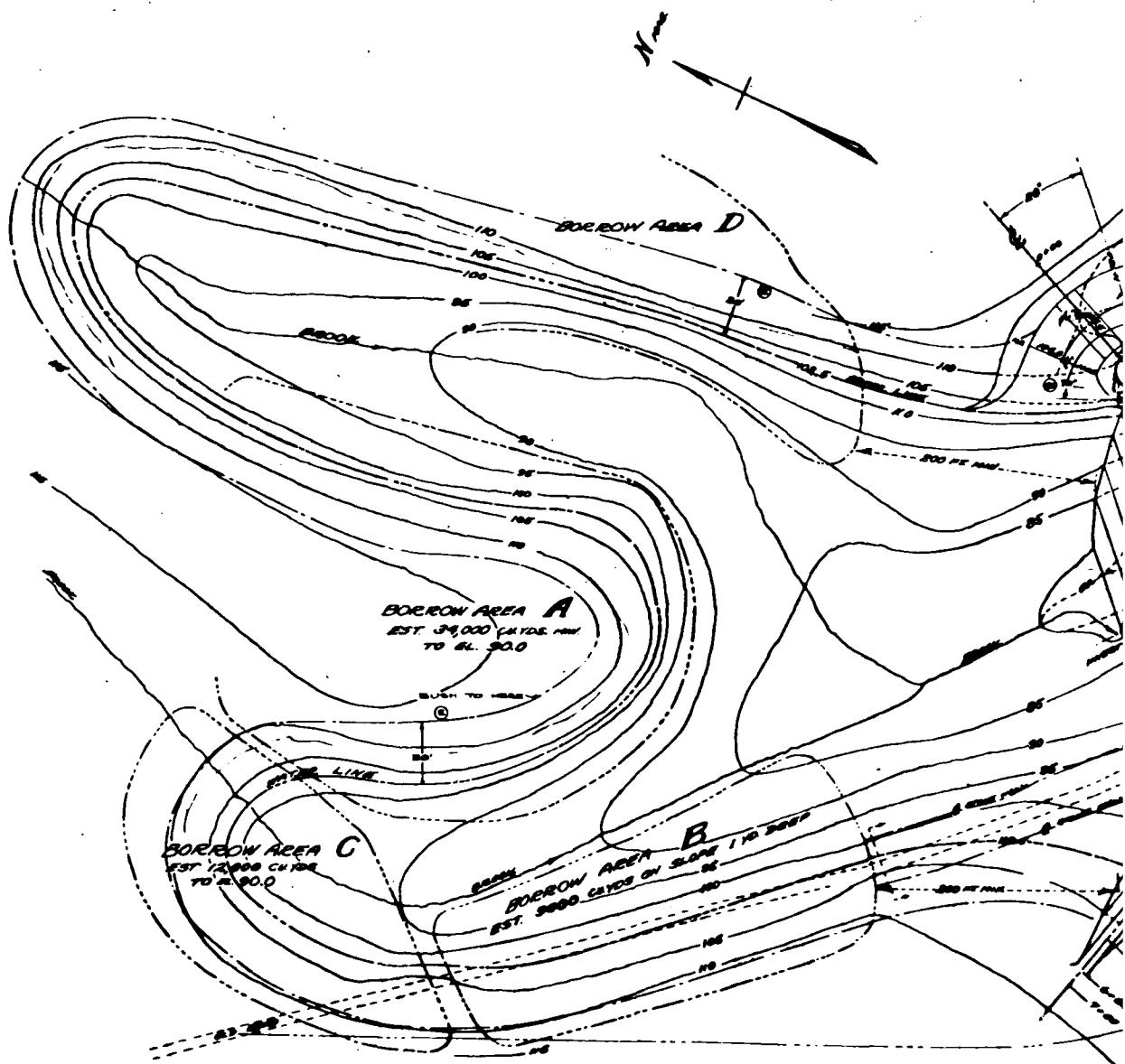


2



NOT TO SCALE

| | |
|------------------------------------|--|
| GENERAL INFORMATION | |
| A. APPROVAL NUMBER | |
| B. APPROVAL DATE | |
| C. VALVE SIZE | |
| D. THROAT SIZE | |
| E. SPECIAL APPROVALS | |
| F. DATE NO. D-4 | |
| G. THE GRANTON ENGINEERING COMPANY | |
| H. THE VERSITEST APPROVAL | |
| I. QUALITY WORKMANSHIP | |
| J. APPROVAL STAMP | |

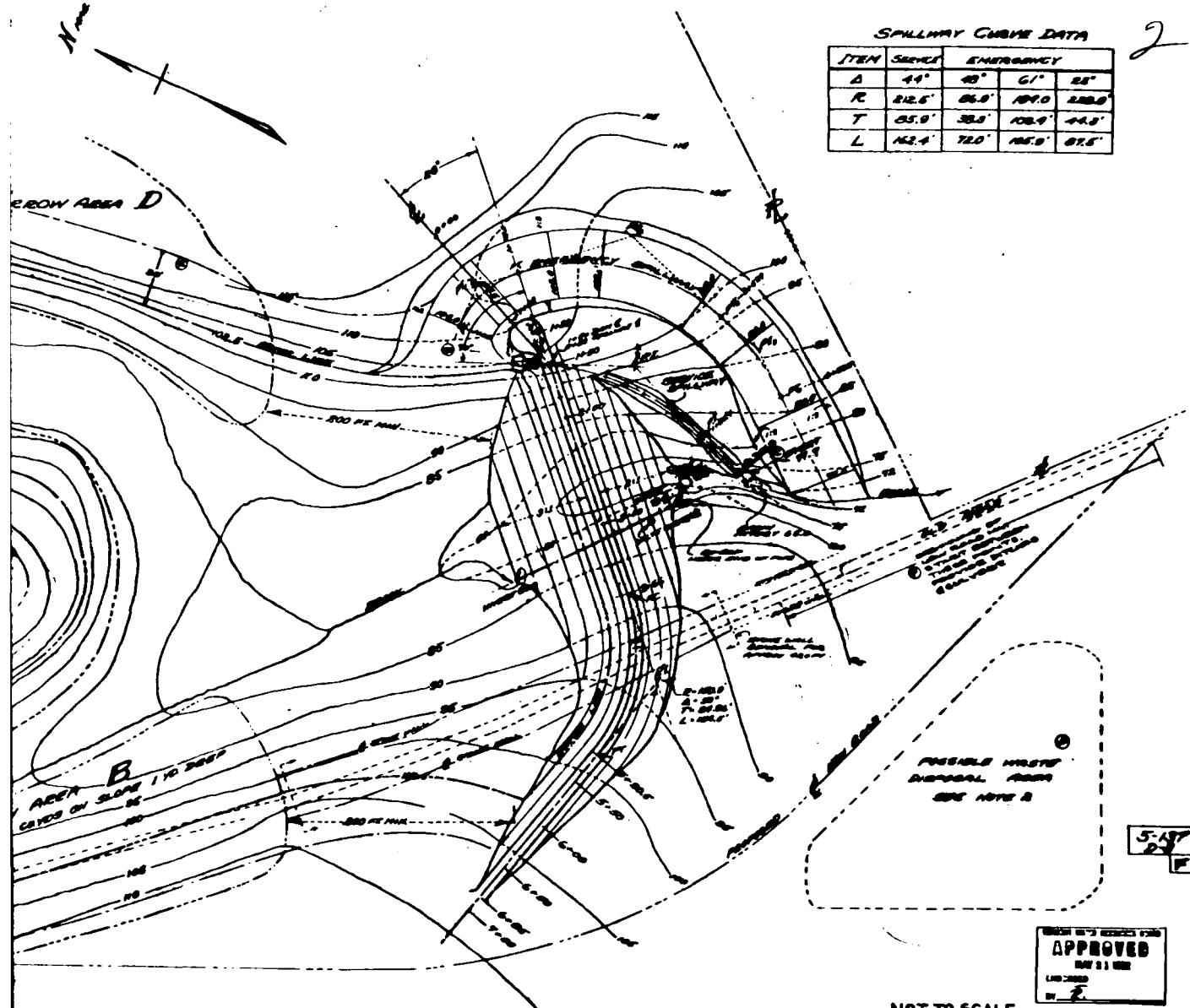


Notes

1. AREAS TO BE TREATED AND SEEDED
 - a. EMERGENCY STALLWAY
 - b. DAM ENHANCEMENT GROUP UPTREAM AND DOWNSTREAM.
 - c. SECOND STALLWAY CONDUIT COVER
2. WASTE DISPOSAL AREA NOT MORE THAN FIVE DAY SITE TO BE DEMONSTRATED BY

SPILLWAY CURVE DATA

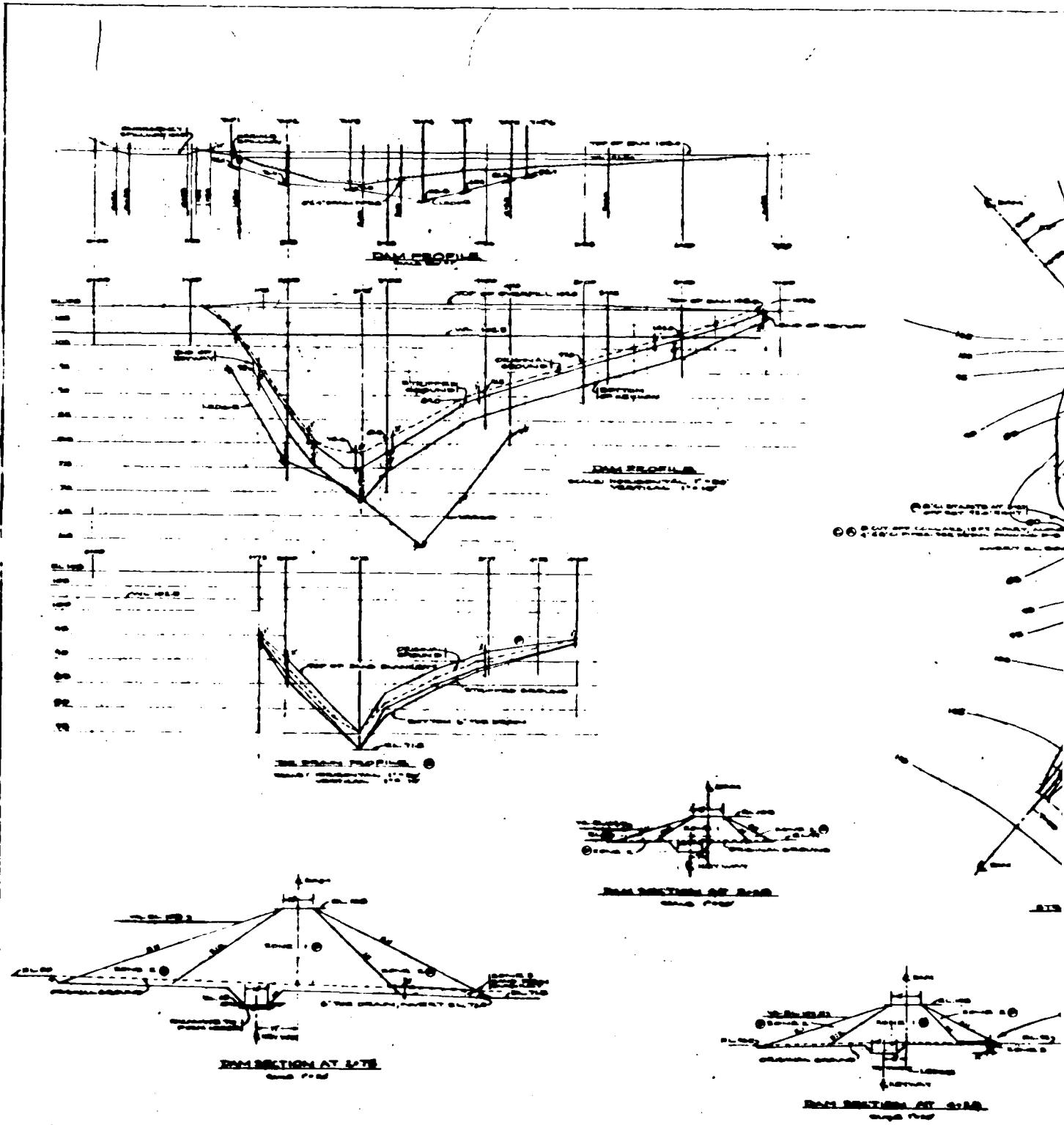
| ITEM | SECTION | EMERGENCY |
|------|---------|------------------------|
| A | 44° | 40° 60° 80° |
| R | 812.6' | 828.6' 1070.0' 2220.0' |
| T | 855.0' | 888.0' 1084.0' 1440.0' |
| L | 162.4' | 172.0' 1865.0' 875.0' |



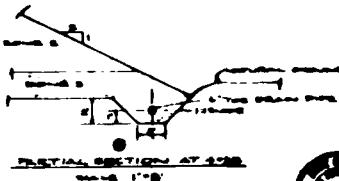
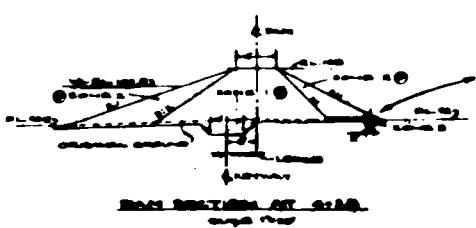
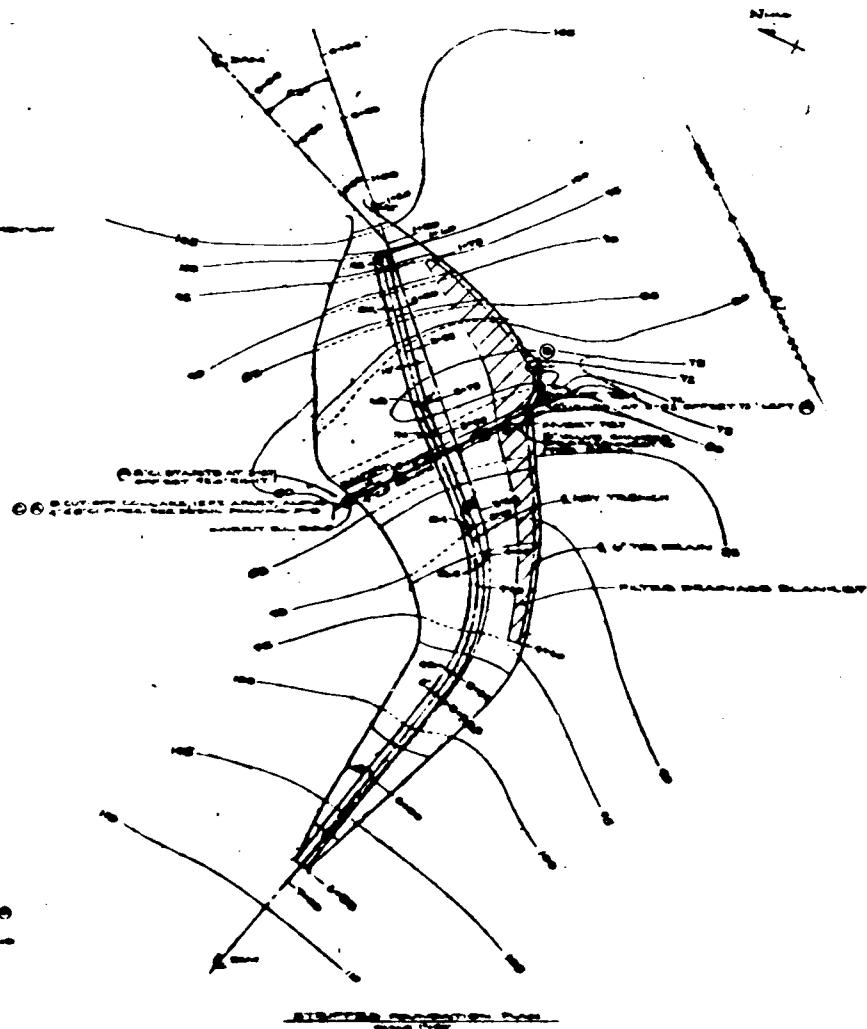
NOTES:

- 1. AREAS TO BE TOPSOILED AND SEEDDED
- 2. EMERGENCY SPILLWAY
- 3. DAM EMBANKMENT EXCEPT MASTERSIDE FACE BOLTED MASTERSIDE.
- 4. SERVICE SPILLWAY CONDUIT COVER.
- 5. WASTE DISPOSAL AREA NOT MORE THAN 800 FT FROM DAM SITE TO BE DESIGNATED BY ENGINEER.

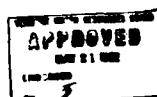
| | |
|--------------------------------|---|
| APPROVED | |
| DATE 11/1968 | |
| LUDWIG | |
| <i>[Signature]</i> | |
| THE GULFON ENGINEERING COMPANY | |
| GENERAL CONTRACTOR | |
| 1 | 2 |
| 3 | 4 |
| GENERAL AGREEMENT | |
| 5 | 6 |
| 7 | 8 |



2

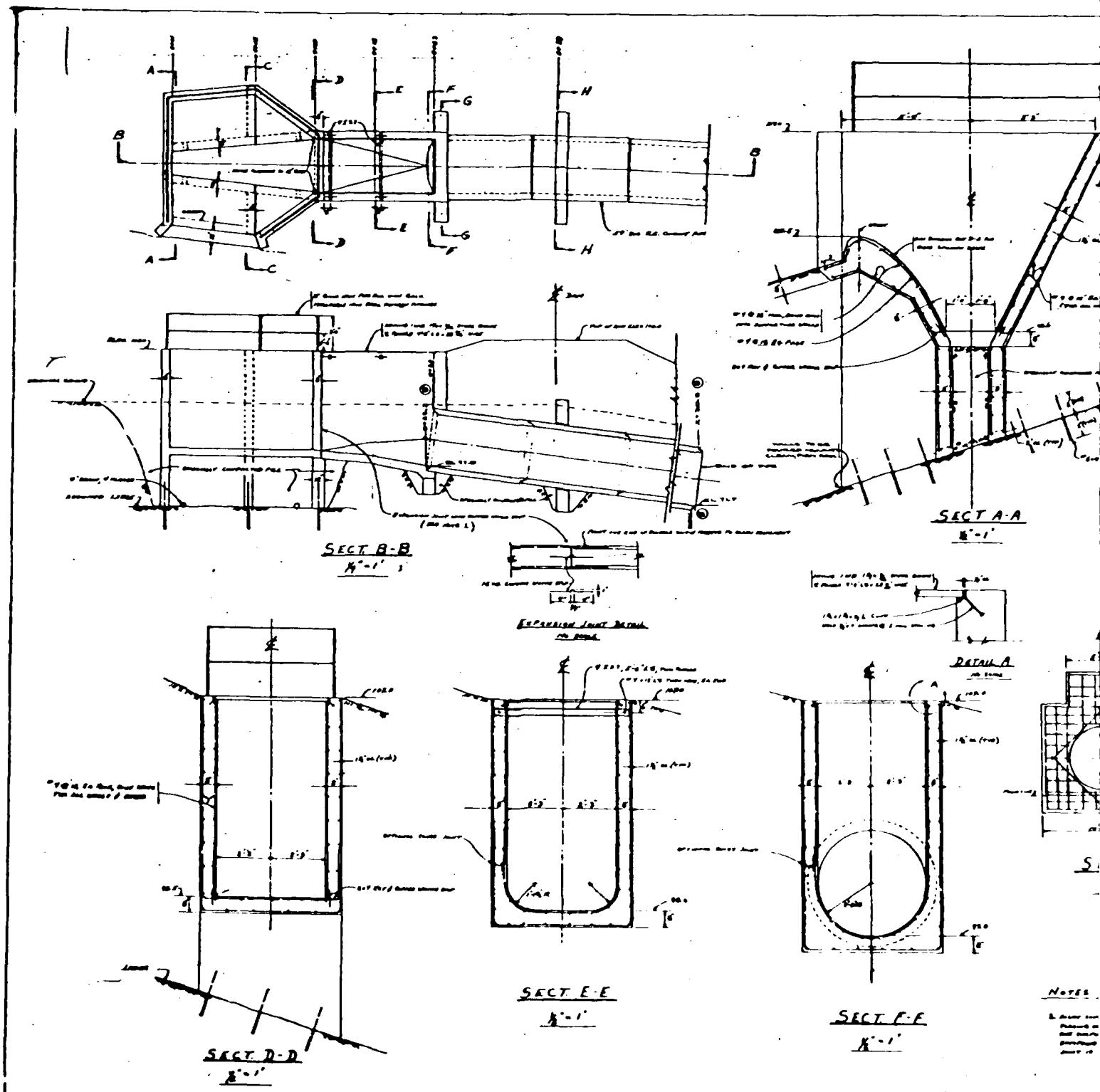


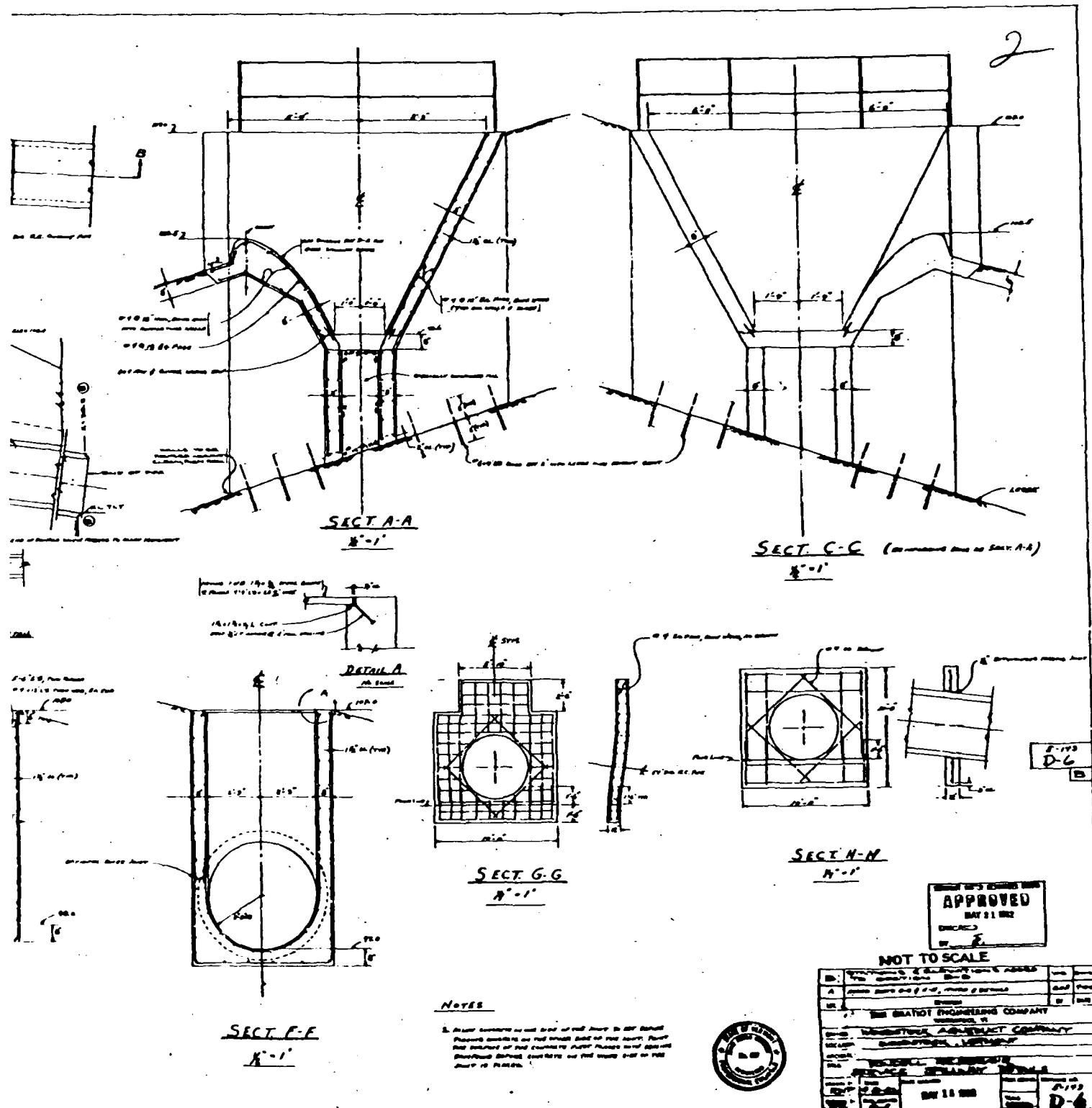
1



NOT TO SCALE

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 | 126 | 127 | 128 | 129 | 130 | 131 | 132 | 133 | 134 | 135 | 136 | 137 | 138 | 139 | 140 | 141 | 142 | 143 | 144 | 145 | 146 | 147 | 148 | 149 | 150 | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 | 176 | 177 | 178 | 179 | 180 | 181 | 182 | 183 | 184 | 185 | 186 | 187 | 188 | 189 | 190 | 191 | 192 | 193 | 194 | 195 | 196 | 197 | 198 | 199 | 200 | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 | 364 | 365 | 366 | 367 | 368 | 369 | 370 | 371 | 372 | 373 | 374 | 375 | 376 | 377 | 378 | 379 | 380 | 381 | 382 | 383 | 384 | 385 | 386 | 387 | 388 | 389 | 390 | 391 | 392 | 393 | 394 | 395 | 396 | 397 | 398 | 399 | 400 | 401 | 402 | 403 | 404 | 405 | 406 | 407 | 408 | 409 | 410 | 411 | 412 | 413 | 414 | 415 | 416 | 417 | 418 | 419 | 420 | 421 | 422 | 423 | 424 | 425 | 426 | 427 | 428 | 429 | 430 | 431 | 432 | 433 | 434 | 435 | 436 | 437 | 438 | 439 | 440 | 441 | 442 | 443 | 444 | 445 | 446 | 447 | 448 | 449 | 450 | 451 | 452 | 453 | 454 | 455 | 456 | 457 | 458 | 459 | 460 | 461 | 462 | 463 | 464 | 465 | 466 | 467 | 468 | 469 | 470 | 471 | 472 | 473 | 474 | 475 | 476 | 477 | 478 | 479 | 480 | 481 | 482 | 483 | 484 | 485 | 486 | 487 | 488 | 489 | 490 | 491 | 492 | 493 | 494 | 495 | 496 | 497 | 498 | 499 | 500 | 501 | 502 | 503 | 504 | 505 | 506 | 507 | 508 | 509 | 510 | 511 | 512 | 513 | 514 | 515 | 516 | 517 | 518 | 519 | 520 | 521 | 522 | 523 | 524 | 525 | 526 | 527 | 528 | 529 | 530 | 531 | 532 | 533 | 534 | 535 | 536 | 537 | 538 | 539 | 540 | 541 | 542 | 543 | 544 | 545 | 546 | 547 | 548 | 549 | 550 | 551 | 552 | 553 | 554 | 555 | 556 | 557 | 558 | 559 | 560 | 561 | 562 | 563 | 564 | 565 | 566 | 567 | 568 | 569 | 570 | 571 | 572 | 573 | 574 | 575 | 576 | 577 | 578 | 579 | 580 | 581 | 582 | 583 | 584 | 585 | 586 | 587 | 588 | 589 | 590 | 591 | 592 | 593 | 594 | 595 | 596 | 597 | 598 | 599 | 600 | 601 | 602 | 603 | 604 | 605 | 606 | 607 | 608 | 609 | 610 | 611 | 612 | 613 | 614 | 615 | 616 | 617 | 618 | 619 | 620 | 621 | 622 | 623 | 624 | 625 | 626 | 627 | 628 | 629 | 630 | 631 | 632 | 633 | 634 | 635 | 636 | 637 | 638 | 639 | 640 | 641 | 642 | 643 | 644 | 645 | 646 | 647 | 648 | 649 | 650 | 651 | 652 | 653 | 654 | 655 | 656 | 657 | 658 | 659 | 660 | 661 | 662 | 663 | 664 | 665 | 666 | 667 | 668 | 669 | 670 | 671 | 672 | 673 | 674 | 675 | 676 | 677 | 678 | 679 | 680 | 681 | 682 | 683 | 684 | 685 | 686 | 687 | 688 | 689 | 690 | 691 | 692 | 693 | 694 | 695 | 696 | 697 | 698 | 699 | 700 | 701 | 702 | 703 | 704 | 705 | 706 | 707 | 708 | 709 | 710 | 711 | 712 | 713 | 714 | 715 | 716 | 717 | 718 | 719 | 720 | 721 | 722 | 723 | 724 | 725 | 726 | 727 | 728 | 729 | 730 | 731 | 732 | 733 | 734 | 735 | 736 | 737 | 738 | 739 | 740 | 741 | 742 | 743 | 744 | 745 | 746 | 747 | 748 | 749 | 750 | 751 | 752 | 753 | 754 | 755 | 756 | 757 | 758 | 759 | 760 | 761 | 762 | 763 | 764 | 765 | 766 | 767 | 768 | 769 | 770 | 771 | 772 | 773 | 774 | 775 | 776 | 777 | 778 | 779 | 780 | 781 | 782 | 783 | 784 | 785 | 786 | 787 | 788 | 789 | 790 | 791 | 792 | 793 | 794 | 795 | 796 | 797 | 798 | 799 | 800 | 801 | 802 | 803 | 804 | 805 | 806 | 807 | 808 | 809 | 810 | 811 | 812 | 813 | 814 | 815 | 816 | 817 | 818 | 819 | 820 | 821 | 822 | 823 | 824 | 825 | 826 | 827 | 828 | 829 | 830 | 831 | 832 | 833 | 834 | 835 | 836 | 837 | 838 | 839 | 840 | 841 | 842 | 843 | 844 | 845 | 846 | 847 | 848 | 849 | 850 | 851 | 852 | 853 | 854 | 855 | 856 | 857 | 858 | 859 | 860 | 861 | 862 | 863 | 864 | 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 | 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 | 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 | 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 | 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 | 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 | 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 | 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 | 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 | 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 | 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 | 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 | 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 | 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 | 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 | 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 | 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 |

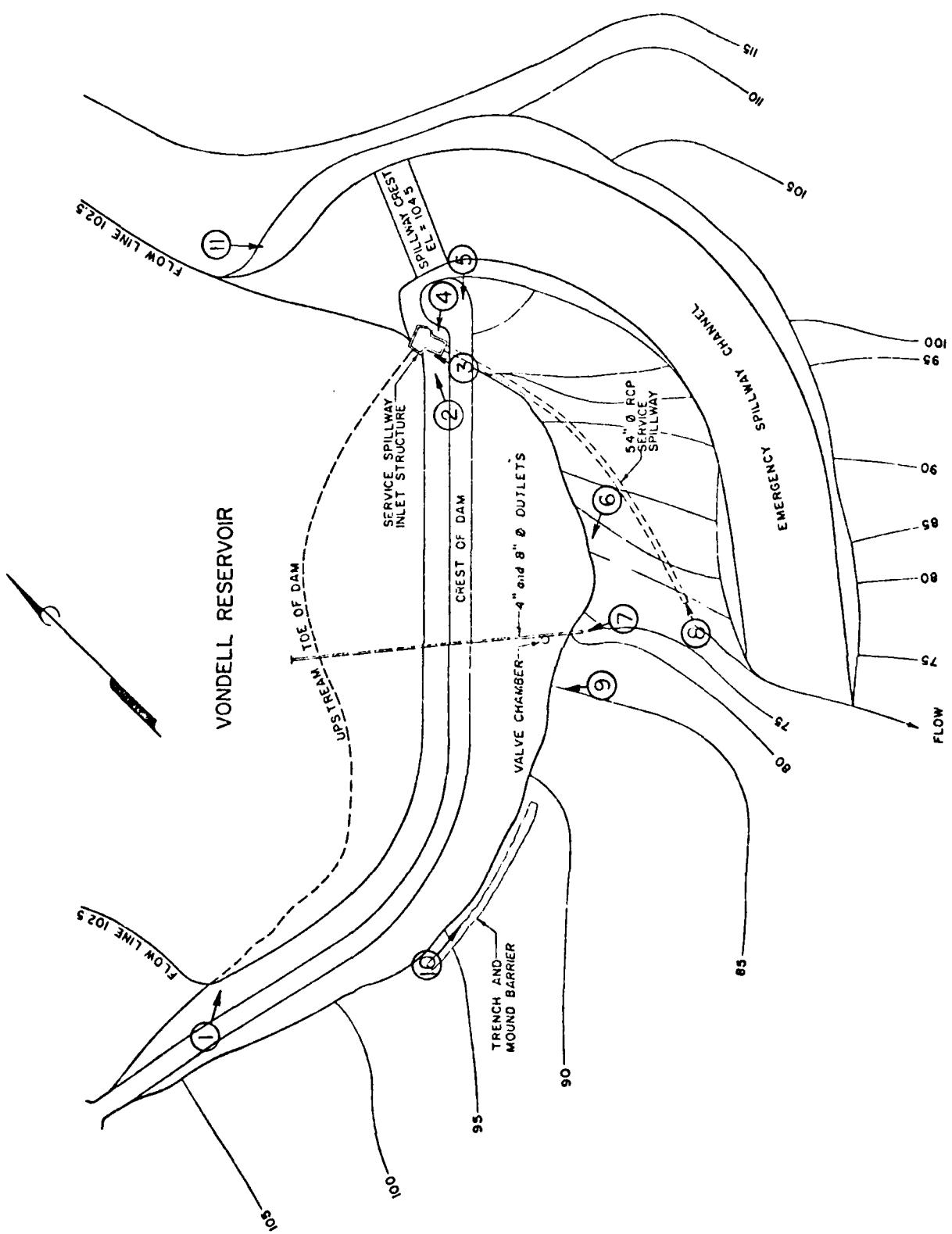



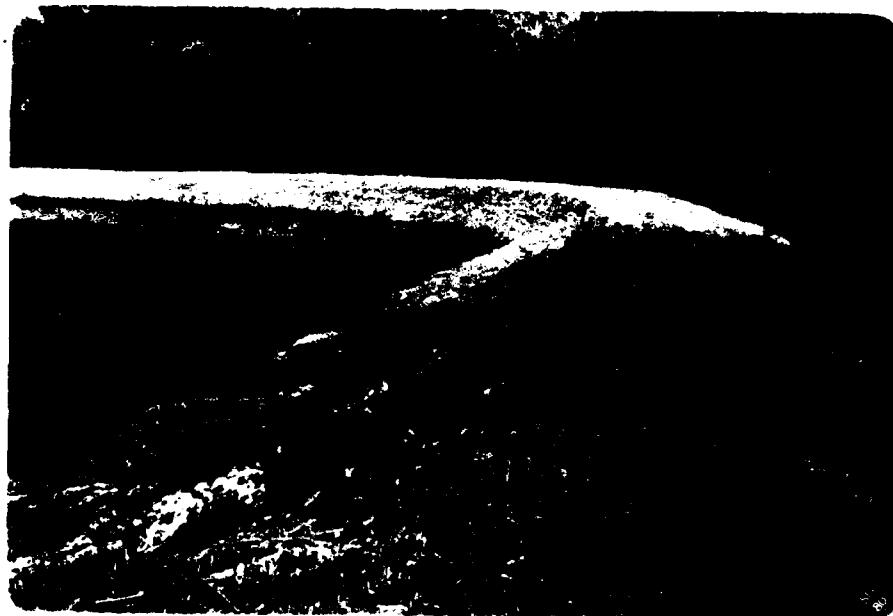


2. **RECENT CHANGES** IN THE STATE OF THE MARKET IN THE SPANISH
PROVINCIAL MARKETS AND THE SPANISH MARKET FOR BEEF. RECENT
TENDENCIES OF THE SPANISH MARKET PLACES AND SPANISH
BEEF-PRODUCING COUNTRIES AND THE WORLD STATE OF THE
MARKET IN SPAIN.

APPENDIX C
DETAIL PHOTOGRAPHS

PHOTO LOCATION PLAN
VONDELL RESERVOIR DAM





(1) Crest and Upstream Slope, From Right Abutment



(2) Service Spillway Inlet Structure

| | | |
|--|---|--|
| U.S.ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | Vondell Reservoir Dam VT 00160 Woodstock, Vermont August 5, 1980 C-2 |
| JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE | | |



(3) Top of Service Spillway Inlet Wall,
Showing Deteriorated Concrete



(4) Depression in Backfill Adjacent to Left Wall of Service Spillway Inlet

| | | |
|--|---|-----------------------|
| U.S.ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | Vondell Reservoir Dam |
| JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE | | VT 00160 |
| | | Woodstock, Vermont |
| | | August 5, 1980 |
| | | C-3 |

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of waterfalls

Computation Job No. 953-051

Computed by I.H.P. Checked by SDM Date 9-23-63

2) Peak Flow and Stage in D15 Stream Reach +

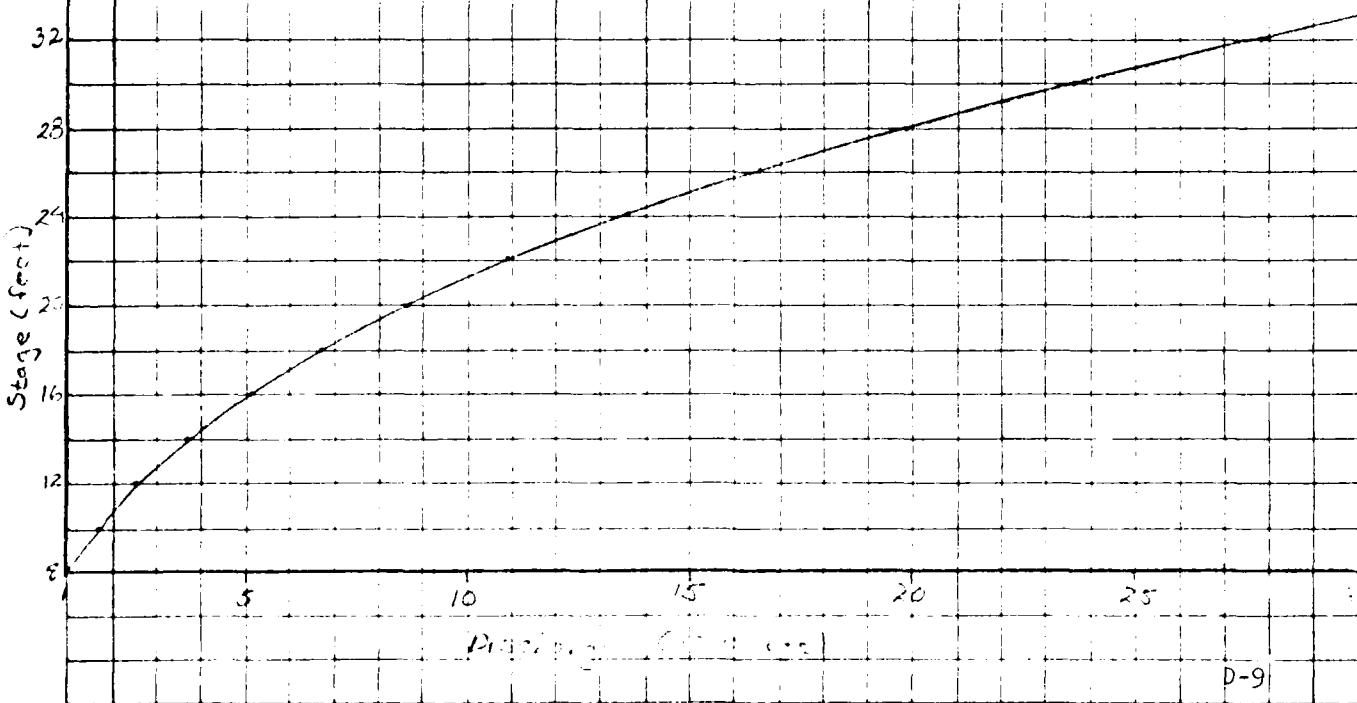
a) Typical Cross-Section - first 2000 feet up of bank

$$Y = 1.425 R^{2/3} C^{1/2} \quad n=0.10$$

S.E. 0.34

$R = 6.44$

| H | A | P | F | Y | Q | H | A | P | B | S | E |
|----|-----|-------|------|------|-------|----|-------|-------|-------|-------|-----|
| 2 | 18 | 13.11 | 1.26 | 3.37 | 61 | 22 | 1 | 1 | 7.82 | 1.14 | 0.7 |
| 4 | 42 | 2.42 | 2.35 | 4.74 | 23.3 | 23 | 10 | 12.93 | 10.73 | 2.2 | 0.1 |
| 6 | 90 | 17.62 | 3.25 | 3.22 | 27.2 | 25 | 16.93 | 17.14 | 11.13 | 10.02 | 1.2 |
| 8 | 149 | 22.84 | 7.13 | 7.07 | 101.6 | 27 | 20.82 | 19.01 | 12.91 | 11 | 1 |
| 10 | 220 | 5.83 | 4.10 | 1.1 | 16.1 | 29 | 17.92 | 16.11 | 11.81 | 11.1 | 1 |
| 12 | 289 | 12.1 | 5.25 | 2.42 | 256.1 | 31 | 12.25 | 11.25 | 11.1 | 3.01 | 1 |
| 14 | 37 | 55.43 | 8.64 | 2.72 | 362.8 | 33 | 5.53 | 5.53 | 5.53 | 5.53 | 1 |
| 16 | 49 | 12.1 | 7.54 | 1.1 | 505.3 | | | | | | |
| 18 | 57 | 12.1 | 8.27 | 1.1 | 67.19 | | | | | | |
| 20 | 72 | 12.1 | 9.22 | 1.1 | 2.73 | | | | | | |



Subject Inspection of mineral claim

Computed by MER Checked by SDM Date 7-7-2020

Dewyhetplash | 5.11.11 | 11:20am

D. Peak Failure Outflow

a) Beach Outflow

① Britain and

$$\text{M.A. Elevation } 5 + 108 - 33\frac{1}{2} = 91.5$$

Opposite hill, elevation 1000 feet = 230 feet. Stream about 100 feet.

FIGURE 1: CREEP RESISTANCE DEMONSTRATION CONCRETE

$$W = 24 \times 1230 = 92 \text{ feet}$$

2) English Writing

$$\omega_0 = 1.8/2\pi \text{ rad/s}$$

Practical applications to top of dam

$$\therefore b_0 = 33 \text{ ft} +$$

11-2 92 fm

2 112 24321 CT

b) Peninsula Spurway District

É um fator importante para o sucesso de um projeto.

Ceratopeltis cincta (Fabricius) sp. n.

Balfour's Fauna & Outfit (C. B.)

Flight 312, 1000 ft R/T 300 ft 1420 ft 30700 ft

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of meat and dairy

Computation Vendelli Reffers Job No. 953-15N

Computed by M.E.B Checked by SDM/EW Date 9-22-83

2) Peak Outflow (Q_{HS})

Using IED-12 Guidelines for Change Storage Fixtures
Alternative Material:

$$Q_p = 320 \text{ cfs} \quad H = 3.2 \text{ feet} \quad T_{flood} = 100 \text{ yr flood}$$

f) Spillway capacity to control

$$Q_{SN} = 1400 \text{ erg}$$

Siphony capacity is 438 % of the outflow @ 100 yr flood

5) Summary

b) Peak Inflow

Test float at 100 yr flood $Q_f = 385 \text{ cfs}$

b) Peak Outflow

$$Q_{+2} = 320 \text{ cfs } @ 100 \text{ yr float}$$

c) Sunday max capacity

$$Q_{S7} = 1900 \text{ cfs}$$

At + T-1, F₁(c,d) = 100 yr flood, the spillways handle the entire flow, utilizing less than 23 % of their capacity with an average headologic over the service spillway crest of 3.2 feet.

Subject Inspection of non-federal dams

Computation Vandell Reservoir Job No. 153-05 N

Computed by MEG Checked by SDM/BW Date 9-22-80

c) Spillway capacity to top of dam el. 108

$$H = 5.5' \quad Q_{sp} = 1400 \text{ cfs}$$

d) Surcharge height to pass Q_{sp}

$$Q_{sp} = 385 \text{ cfs} \quad H = 3.35 \text{ feet over service spillway}$$

A) Effect of Surcharge carrying Probable Distances

a) Lake area varies with surcharge

see curve p. 2 - surcharge volume = storage = 73 acre-feet

b) Assume normal pool level at spillway crest el 102.5

c) Watershed area = 0.65 mi²

d) Discharge (Q_{sp}) at various surcharge elevation:

$$H = 5' (\text{el } 107.5) \quad V = 102.5 - 73 = 3.5 \text{ acre-feet}$$

$$S = 3.5 / (0.65)(3.2) = 1.21''$$

$$H = 2.5'' (\text{el } 105.0), \quad V = 91.73 = 18 \text{ acre-feet}$$

$$S = 1.8 / (0.65)(3.2) = .52''$$

From Approximate Storage Routing Guidelines

(19" max total fall 2.0 in New England)

$$Q_{sp} = C_d (1 - S/3.0) \approx 15 \text{ ft/E} \quad Q_{sp} = 385 \text{ cfs}$$

$$\text{For } H = 5 \quad Q_{sp} = 280 \text{ cfs}$$

$$H = 2.5 \quad Q_{sp} = 330 \text{ cfs}$$

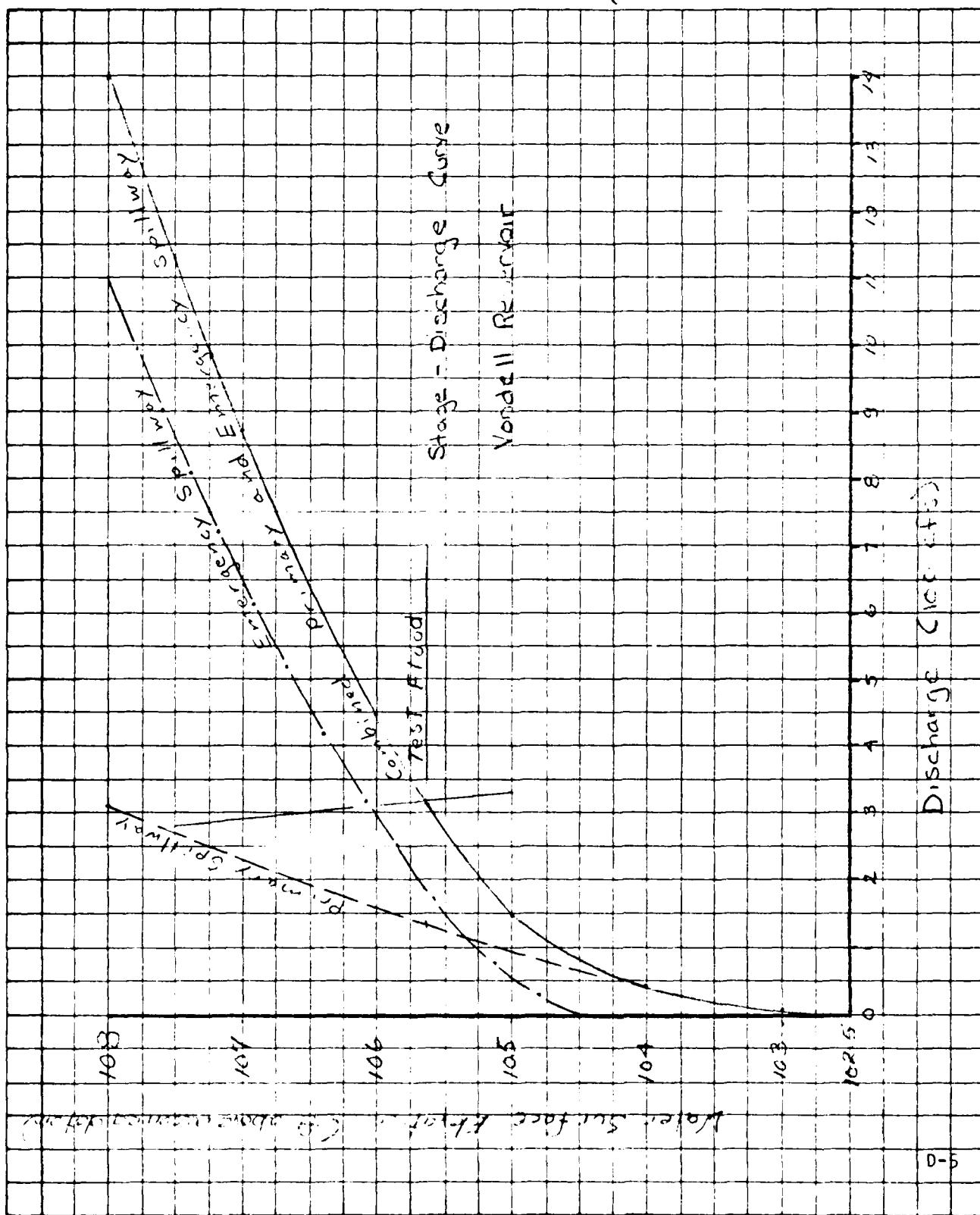
JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of non-federal dams

Computation Yonkers Reservoir Job No. 953-051

Computed by MEP Checked by SDY/BW Date 9-19-81



JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of manufactured products

Computation Job No. 953-05A

Computed by R. P. S. Checked by SPN/BW Date 9-19-81

b) Test Flood = 100-yr flood $\therefore Q_2 = 3.85 \text{ cfs}$

$$b) \text{ Test Flood} = 100 \text{ yr. flood} \quad \therefore Q_2 = 3.85 \text{ cfs}$$

23 September 1944 John. 10:11

a) Peak Inflow Q_p = 385 cfs

b) Outflow Rating Curve

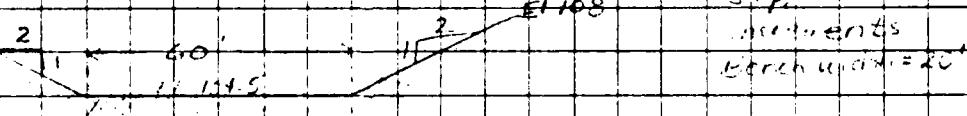
Primary Spillway - concrete spillway (crest el. 102.5) discharging to a 54" Q RCP. 7' wide section vertical flow.

$i + \text{CH}_3\text{H}^{3/2}$ L = 7 C = 3.4

| H | G | WSE | H | Q | WSE |
|-----|-----|-------|-----|-----|-------|
| 5 | 8 | 103.0 | 3.5 | 227 | 107.7 |
| 1.5 | 14 | 109.0 | 5.5 | 307 | 108.3 |
| 2.5 | 99 | 105.1 | 6.5 | 394 | 109.0 |
| 3.5 | 153 | 106.4 | 7.5 | 489 | 110.0 |

Diagram illustrating flow conditions in a trapezoidal channel:

- Flow Type:** Subcritical (Froude Number $F = 1.15 < 2.0$)
- Flow Depth:** $h = 1.145 \text{ m}$
- Width at Bed:** $B = 1.145 \text{ m}$
- Width at Water Surface:** $B + 2h = 3.345 \text{ m}$
- Width at Top:** $B + 2h + 2B_0 = 5.545 \text{ m}$
- Angle of Channel Wall:** $\theta = 60^\circ$
- Flow Velocity:** $V = 1.108 \text{ m/s}$
- Flow Area:** $A = 1.108 \times 1.145 = 1.25 \text{ m}^2$
- Hydraulic Radius:** $R = A/B = 1.25/1.145 = 1.09 \text{ m}$
- Head Loss:** $H_f = 0.0145 \text{ m}$
- Head Gain:** $H_g = 0.0145 \text{ m}$
- Channel Width at Top:** $B + 2h + 2B_0 = 5.545 \text{ m}$



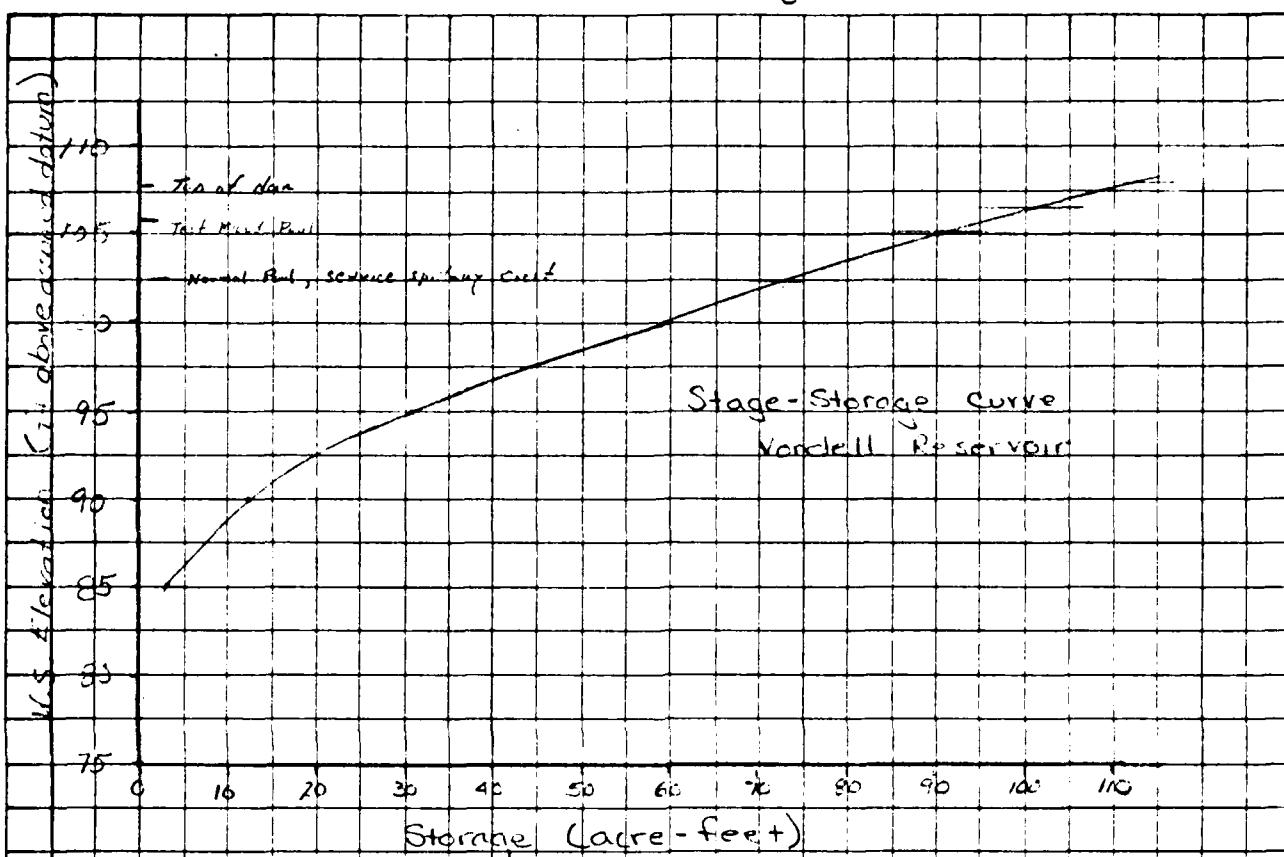
| H | G | w\$ | EI |
|-----|------|-------|----|
| .5 | 55 | 105.0 | |
| 1.5 | 792 | 106.0 | |
| 2.5 | 643 | 107.0 | |
| 3.5 | 1091 | 115.0 | |

outflow conduit (normally closed) - 80' long, 20' diam. head 100
 200' of same size K_c = 0.83 $\frac{100}{C})^{0.83} \frac{g}{f} = 355$
 $C = 120, f = 25/100^2$ D-4
 52" E 9 cfs Gy. x 1 off

Subject Inspection of non-federal dams

Computation Vandell Reservoir, Litchfield, Vt Job No. 953-05A

Computed by MEL Checked by SAC Date 9-17-80



Stage - Storage curve computed from contour area
in drawing # 5-137 D-3, "General Arrangement; Grattan
Engineering Company."

(ii) Hazard Potential

Failure flows would cause further damage to those
left after reservoir previously mentioned by pre-failure
flows. The failure flow would also enter the (and probably fill)
Cox Reservoir Dam about 700' off. According to a previous
Phase 2 Report, Cox Dam has potential to flood two residences upon
failure with the potential loss of a few lives. These residences
would be flooded by the Vandell breach flow regardless of filling of Cox.

(iii) Classification

Size: Small

Hazard: Significant

D-3

Subject Inspection of non-tension dams

Computation Vandell Reservoir, Woodstock, Vt. Job No. 953-05N

Computed by JFJ Checked by SDH/BW Date 9-15-67

Hydrologic / Hydraulic Inspection

Performance in Test Flood Conditions

a) Maximum Precipitation Estimates

a) Watershed classified as "Mountainous"

b) Watershed Area

0.65 sq. miles - planimetric from 1:250000 USGS sheet
TWS average of 3 trials

0.54 sq. miles - Vt Dept of Water Resources Tech. Note

c) From NED-ACE "Preliminary Guidance for Estimating Max. Probable Discharges + Guide Curve For PMF - Peak Flow Rates:

$$PMF \approx 2950 \text{ cfs / square mile}$$

d) Peak Inflow

$$Q_p = (2950 \text{ cfs / mi}^2)(0.65 \text{ mi}^2) \approx 1920 \text{ cfs @ PMF}$$

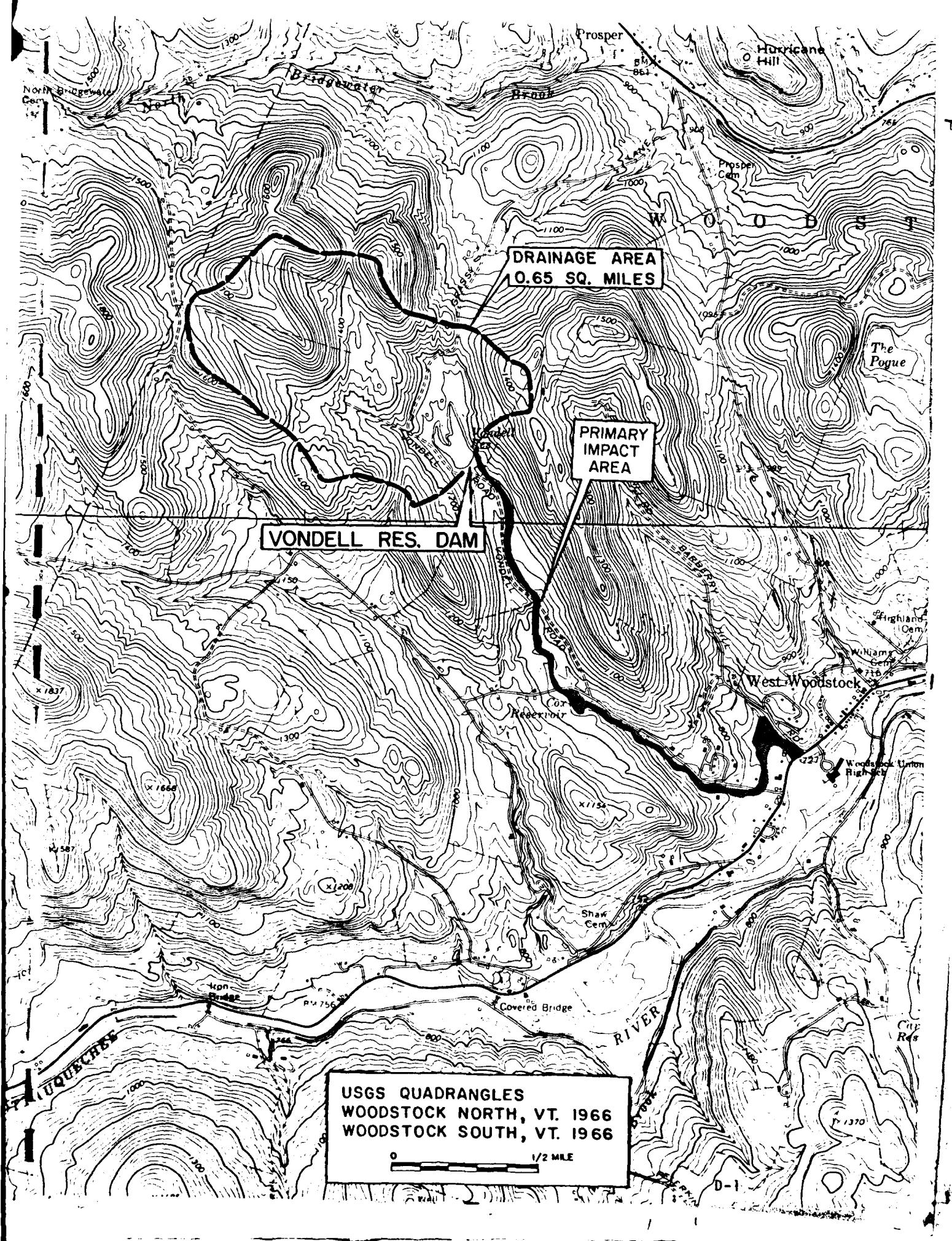
Similarly @ 1/2 PMF $Q_{p/2} \approx 960 \text{ cfs}$
100 yr flood $\approx 1/5 \text{ PMF} = 385 \text{ cfs}$

U.S. Dept of
Commerce Tech
Paper #40
p-58

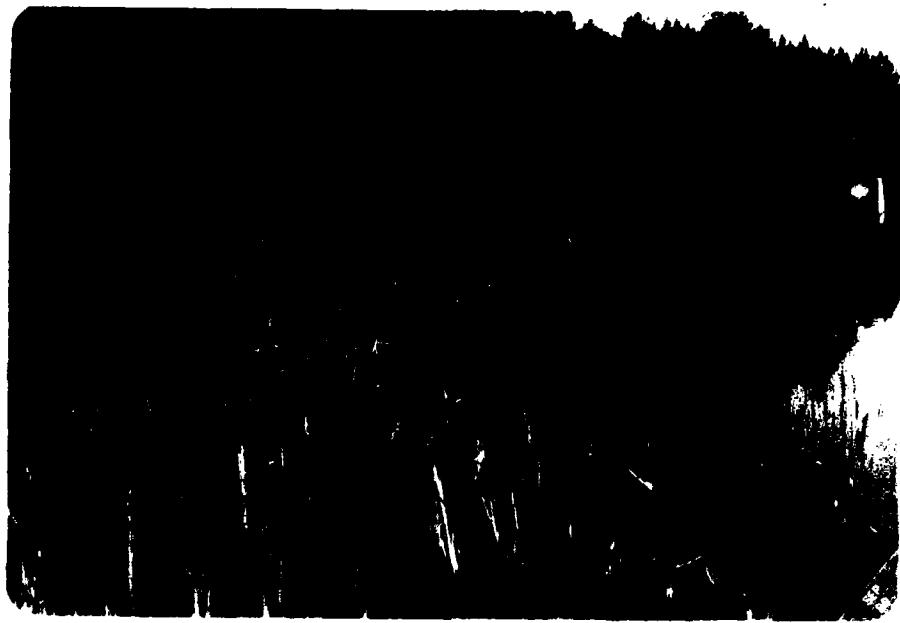
e) Test Flood

f) Classification of Dam According to NED-ACE Hydrologic Guidelines

g) Size: Surface area 114 acre-feet
height 33 feet (108-75)



APPENDIX D
HYDRAULIC/HYDROLOGIC COMPUTATIONS



(11) Emergency Spillway Inlet Channel; Service Spillway in Right Background

| | | |
|--|---|--|
| U.S.ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | Vondell Reservoir Dam VT 00160 Woodstock, Vermont August 5, 1980 C-7 |
| JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE | | |



(9) 6" CMP Toe Drain Outlet



(10) Trench Excavated at Downstream
Toe of Dam

| | | |
|--|---|-----------------------|
| U.S.ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | Vondell Reservoir Dam |
| JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE | | VT 00160 |
| | | Woodstock, Vermont |
| | | August 5, 1980 |
| | | C-6 |

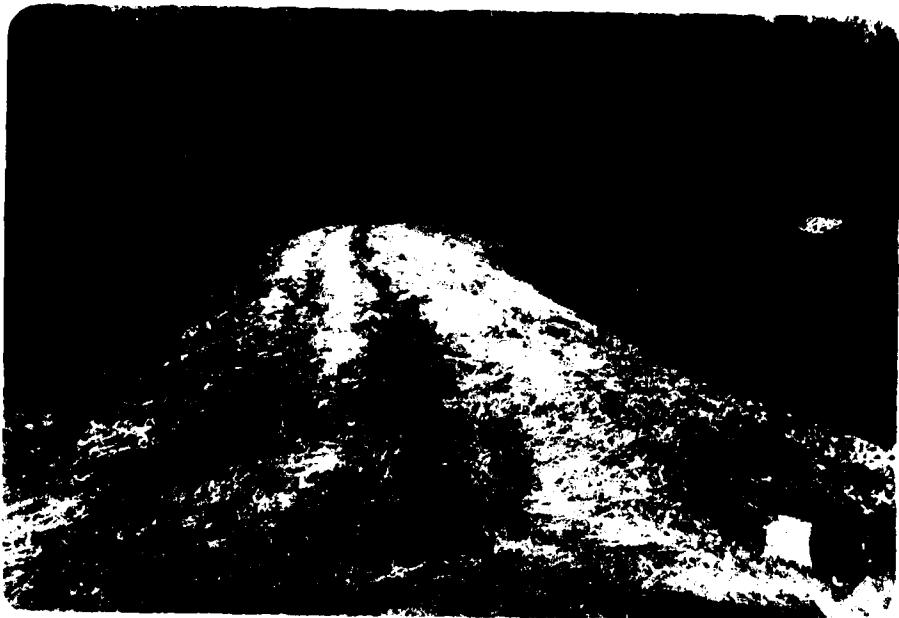


(7) 4" and 8" Diameter Outlet Pipes at Toe of Dam



(8) 54" Diameter Service Spillway
Outlet Pipe.

| | | |
|--|---|--|
| U.S.ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | Vondell Reservoir Dam VT 00160 Woodstock, Vermont August 5, 1980 C-5 |
| JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE | | |



(5) Crest of Dam from Left Abutment



(6) Valve Chamber and Valve Boxes on Downstream Slope of Dam

| | | |
|--|---|---|
| U.S.ARMY ENGINEER DIV, NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASSACHUSETTS | NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | Vondell Reservoir Dam VT 00160 Woodstock, Vermont August 5, 1980 |
| JAMES W. SEWALL COMPANY CONSULTANTS OLD TOWN, MAINE | | C-4 |

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Triplication - 1000 ft. dam

Computation Vernon Reservoir Job No. 952-1-11

Computed by MEP Checked by SDM Date 7-23-11

b) Streamflow = 1000 ft. dam

Reservoir elevation at time of triplication = 144 ft + ft

i. Pre-failure stages in stream (approximate)

$$Q_{p1} = 14000 \text{ cfs} \quad V_1 = 192.4 \text{ cu ft} \quad \text{Elevation: } 144 \text{ ft}$$

2) Failure stages

$$Q_{p2} = 30700 \text{ cfs} \quad V_2 = 182.2 \text{ cu ft}$$

3) Aerial view shows $V_1 = 182.2 \text{ cu ft} = 113.0 \text{ cu ft}$

$$\begin{aligned} Q_{p2} (\text{trial}) &= Q_{p1} (1 - \frac{V_1}{V_2}) \\ &= 20700 (1 - \frac{113.0}{182.2}) \end{aligned}$$

$$15000 \quad 31400 \text{ cfs} \quad V_1 = 182.2 \text{ cu ft}$$

$$4/5 \quad V_2 = 76.92 \text{ cu ft} \quad V_2 = 31.45 \text{ cu ft}$$

$$\begin{aligned} Q_{p2} &\neq Q_{p1} (1 - \frac{V_1}{V_2}) \\ &= 20700 (1 - \frac{31.45}{76.92}) \end{aligned}$$

$$18500 \text{ cfs} \quad (31.45 \text{ cu ft})$$

$$\begin{aligned} Q_{p2} (\text{trial}) &\neq Q_{p1} (1 - \frac{V_1}{V_2}) \quad V_1 = 29.45 \text{ cu ft} \\ 15000 &= 10800 (1 - \frac{29.45}{76.92}) \end{aligned}$$

$$3/5 \quad 12500 \text{ cfs} \quad V_2 = 65.75 \text{ cu ft} = 26.8 \text{ cu ft}$$

$$4/5 \quad Q_{p2} = 16100 \text{ cfs} \quad (26.8 \text{ cu ft})$$

$$18500 \text{ cfs} \quad (26.8 \text{ cu ft})$$

$Q_{p2} = 12500 \text{ cfs} \quad 25.5 \text{ cu ft}$
e. Vandell Road crossing

Surficial water 10

Pre-failure stages at Vandell Road crossing
Failure stages

Failure stages = 6.5 feet at Vandell Road

D-10

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Design of non-fail dam

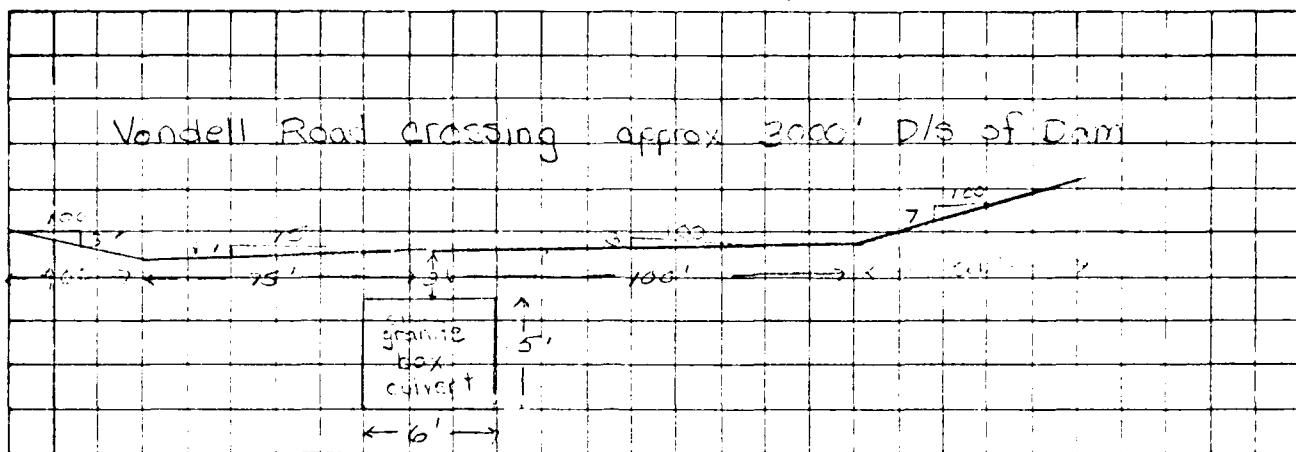
Computation Vondell Road

Job No. 953-05 N

Computed by H.A.

Checked by SDM

Date 9.23.77



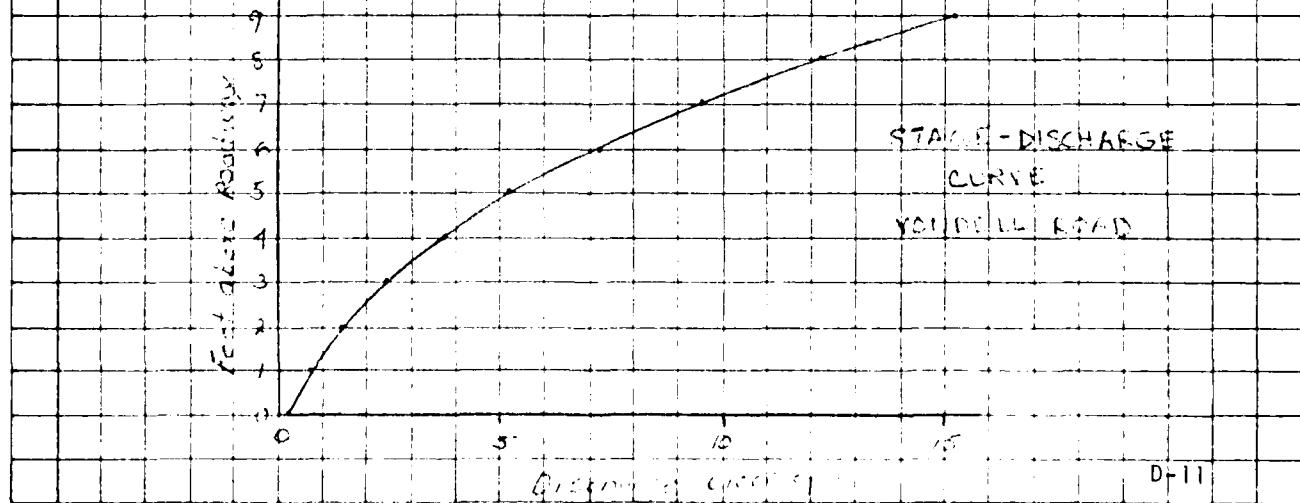
Culvert

$$\text{draulic fr. approx } 17+2 = 19 \quad i = 3'' \quad Q = 33.5^2 \quad C=1.5$$

$$\therefore Q_{\text{min}} \approx 200 \text{ cfs}$$

Overland Flow $Q = CLH^{3/2} \quad i = 1.5 \quad \text{approx 1 min.}$

| H in ft | Q | H | Q | H | Q |
|--------------|------|-----|------|-----|-------|
| 1 | 552 | 4 | 2442 | 7 | 2352 |
| 2 | 1227 | 5 | 504 | 8 | 12000 |
| 3 | 2213 | 6 | 7441 | 9 | 15121 |



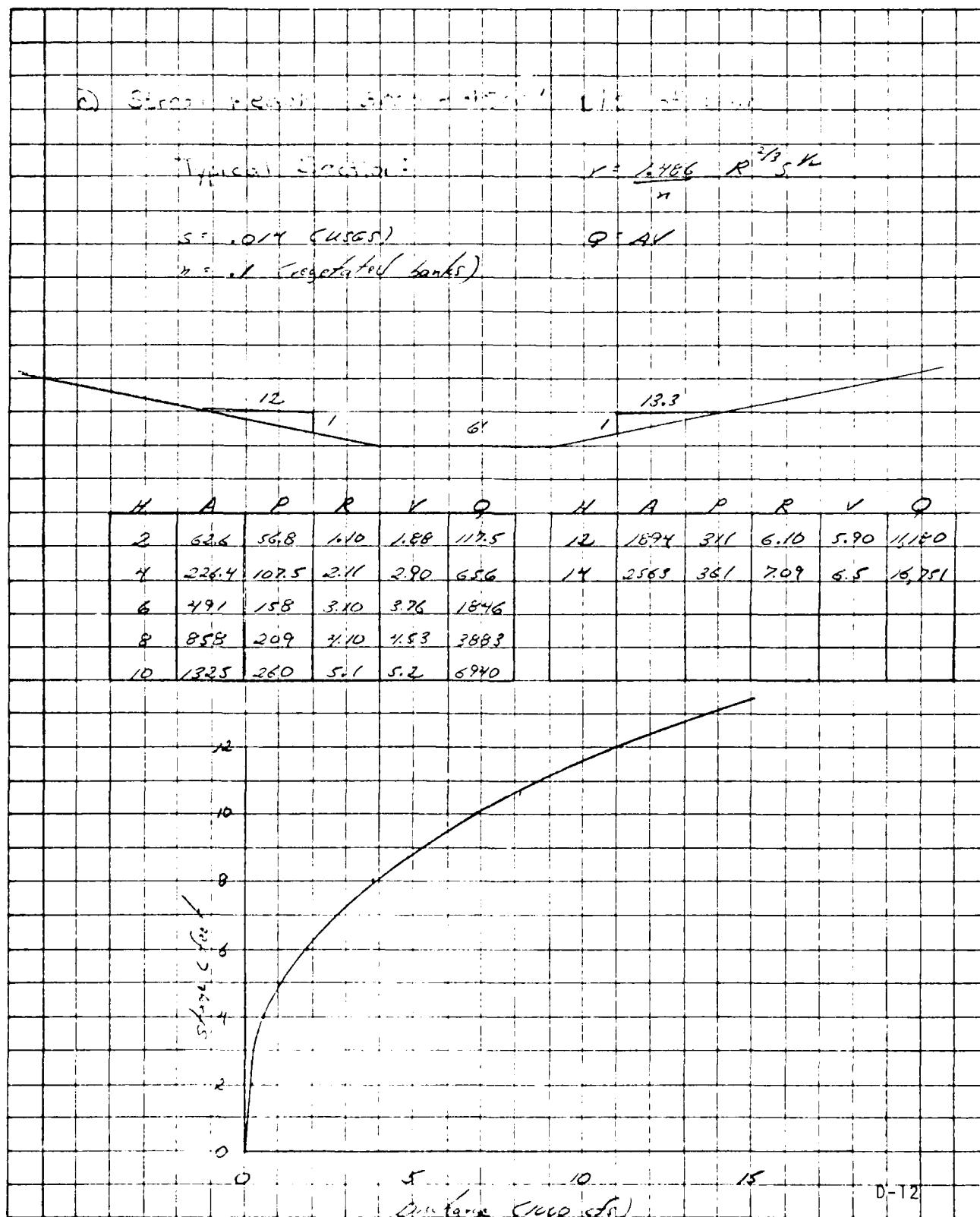
JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of non-Lateral dikes

Computation Lateral Reservoir Job No. 953-05N

Computed by SDY Checked by M.E.B. Date 9/26/80



JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of non-federal dams

Computation Kendall Reservoir Job No. 953-05 N

Computed by SOM Checked by M.E.B Date 9/26/80

d) Storage Routing - storage peak 3000-3500' D/S of Dam

Reservoir storage at time of failure $V = 114 \text{ Ac-ft}$

e) Pre-failure storage in reach (typical section p. 11)

$$Q_{pr} = 1700 \text{ cfs} \quad V = 401 \text{ ft}^2 \times 1500' = 13.8 \text{ Ac-ft} \\ 13,800$$

f) Failure storage

$$Q_f = 13,500 \quad V = 2182 \text{ ft}^2 \times 1500' = 75.1 \text{ Ac-ft} \\ 73,500$$

g) Available storage in reach $V_f = 75.1 - 13.8 = 61.3 \text{ Ac-ft}$

$V_f > \frac{1}{2} \text{ : cut reach in half}$

$$Q_{pr} (\text{Trial}) = Q_p \left(1 - \frac{V_f}{V_p}\right) \\ = 13,500 \left(1 - \frac{61.3}{114}\right) \\ = 9864 \text{ cfs (at 3750' D/S)}$$

and 3500' D/S - $V_2 = 30 - 13.8 = 23.1$

$$Q_f = Q_p \left(1 - \frac{V_f}{V_p}\right) \\ = 13,500 \left(1 - \frac{23.1 - 30.2/2}{114}\right) \\ = 10,314 \text{ cfs @ 3750' D/S}$$

$$Q_p (\text{Trial}) = Q_p \left(1 - \frac{V_f}{V_p}\right) \quad V_f = \frac{62 - 13.8}{2} = 24.1 \\ = 10,314 \left(1 - \frac{24.1}{114}\right) \\ = 8134 \text{ cfs}$$

3750-4150' D/S - $V_2 = 52.1 - 13.8 = 19.2$

$$Q_f = Q_p \left(1 - \frac{V_f}{V_p}\right) \\ = 10,350 \left(1 - \frac{19.2 - 24.1}{114}\right) \\ = 8350 \text{ cfs @ 4150' D/S of Dam}$$

JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

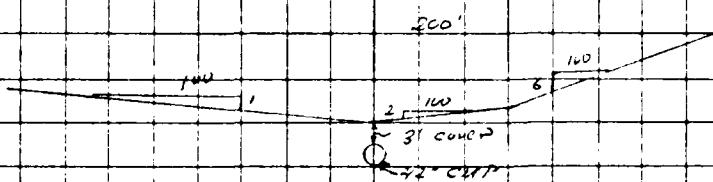
Sheet _____ of _____

Subject Inspection of non-tidal dams

Computation Kandell Receipted Job No. 253-0511

Computed by SDY Checked by MEB Date 9/26/80

Town Beach Dam 4000' + 20' at dam



From Handbook of Steel Design in Highway Construction Projects
P-10, cultural capacity = 40 cfs

$$Q = C_d H^{1/2} \quad C = 2.5$$

Flow over road

| H | Q | H | Q |
|----|-------|-----|----------|
| 2 | - | 2.2 | 910 cfs |
| 4 | 7 cft | 2.4 | 1100 " |
| 6 | 26 " | 2.6 | 1317 " |
| 8 | 61 " | 2.8 | 1562 " |
| 10 | 114 " | 3 | 1835 " |
| 12 | 189 " | 4 | 2668 " |
| 14 | 286 " | 5 | 3364 " |
| 16 | 412 " | 6 | 40,028 " |
| 18 | 564 " | | |
| 20 | 745 " | | |

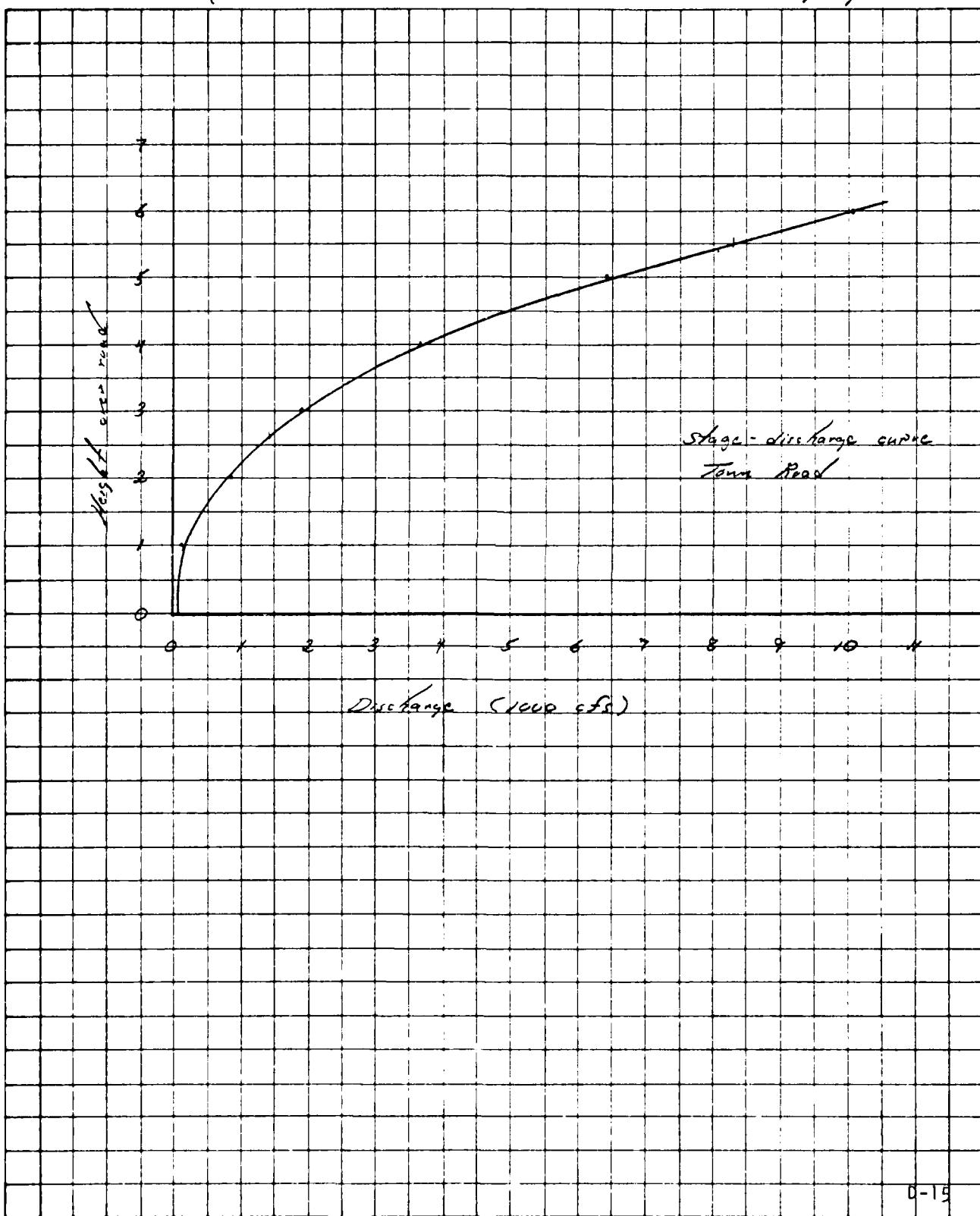
JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of non-federal dams

Computation Vassell Reservoir Job No. 853-05 N

Computed by SDH Checked by MEB Date 9/29/80



JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

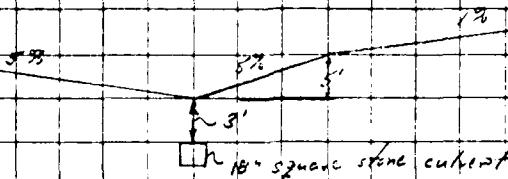
Sheet _____ of _____

Subject Inspection of non-federal dam

Computation Kenckill Reservoir Job No. 953-05 N

Computed by SDJ Checked by MEB Date 9-29-80

1:6
Drainage crossing 3600' S of dam



Culvert

Rough estimate flow using surface equation

$$Q = C A \sqrt{2gH} \quad A = 3'; \quad n = 3.25 \text{ ft}^2, \quad C = .5$$

$$Q = 15.6 \text{ cfs}$$

Rod

$$Q = C L H^{3/2} \quad C = 2.5$$

| H | Q | X | Q |
|----|-------|---|----------|
| .2 | - cfs | 3 | 532 cfs |
| .4 | 2 " | 4 | 1200 " |
| .6 | 7 " | 5 | 2127 " |
| .8 | 16 " | 6 | 5894 " |
| 1 | 30 " | 7 | 10,255 " |
| 2 | 189 " | 8 | 16,797 " |

D-16

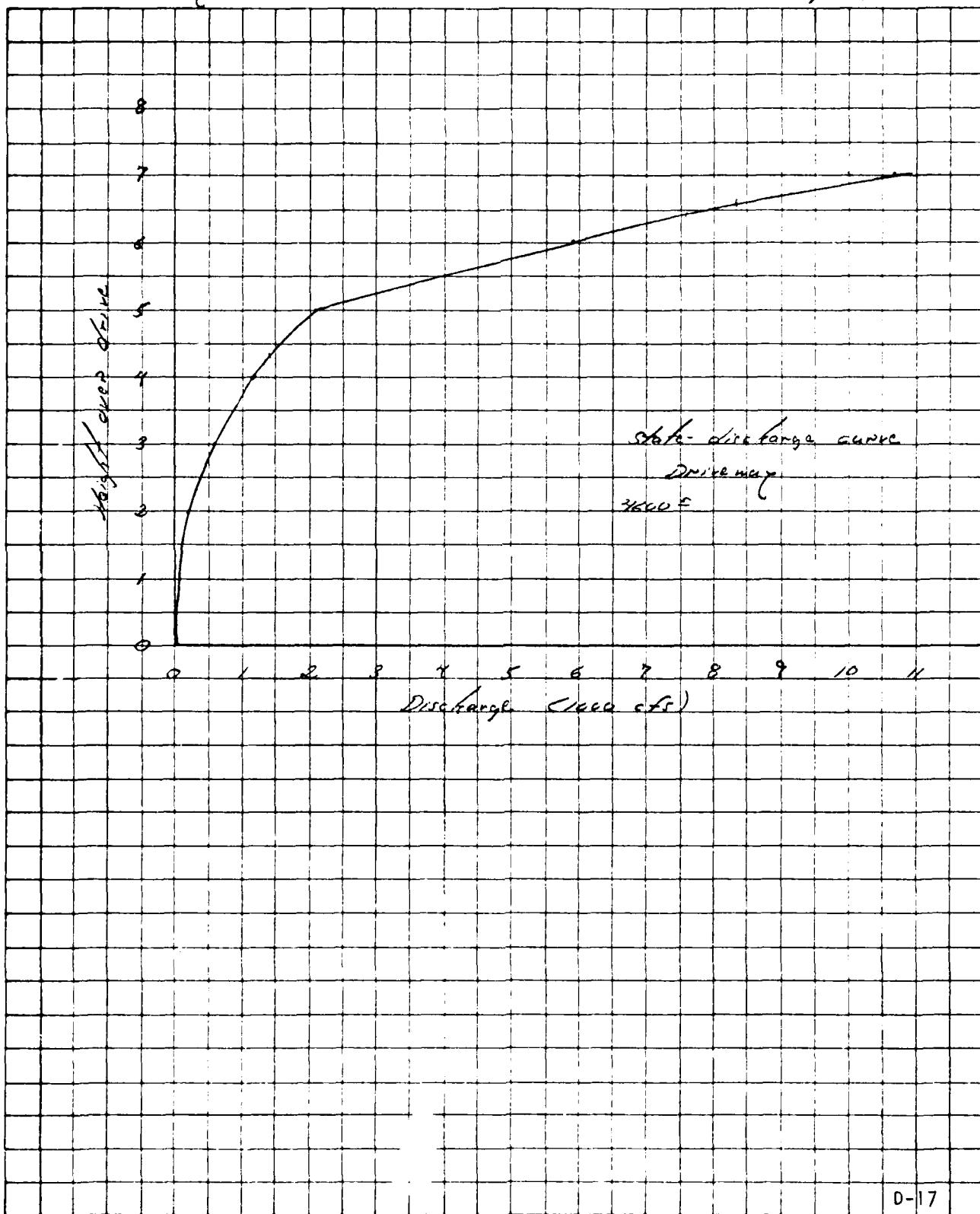
JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Licensing of non-federal dams

Computation Taft Hill Reservoir Job No. 953-05N

Computed by SDM Checked by MER Date 9/29/80



JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of non-failed areas
Computation 100% Reservoir Job No. 953-05N
Computed by SDM Checked by MEB/BW Date 1-29-80

Summary

a) Peak Failure Outflow

$$Q_f = 10,000 \text{ cfs} \quad (\text{Peak failure flow} = 1400 \text{ cfs})$$

b) Approximate Stage before Failure

Randall Rd. H = 10'

Town Rd. 4500' off H = 9'

Driveway 4600' off H = 9'

c) Approximate Stage after Failure

Assume roadway embankments remain after pre-failure flow?

Randall Rd. H = 16.5'

Town Rd. road - 0/5 H = 12'

Driveway 4600' off H = 11'

d) New or stage

Randall Rd. 16.5'-10' = 6.5'

Town Rd. 12'-9' = 3'

Driveway 11'-9' = 2'

e) Effect upon Cox Reservoir (4500' off 0/5)

Partial failure in New St. Cox Reservoir =

8100 cfs, dam would be approx. 8.8' above MHL

at 6.8' above Cox Dam except that for failure.

f) Randall would fail Cox Dam. If Cox Dam

did not fail, 2/5 of flow at 8100 cfs would

be in same range as computed Cox outlet flow

at 6800 cfs and hazard would be approximately

the same as with Cox failure - i.e. flooding would

be flooded to a depth of 3 or 4 feet. Cox

current height at Cox would result in greater damage

to downstream.

D-18

Subject Inspection of Non-Federal Dams

Computation Vandell Reservoir Woodstock, VT job No. 953-05N

Computed by BW Checked by _____ Date 11-17-80

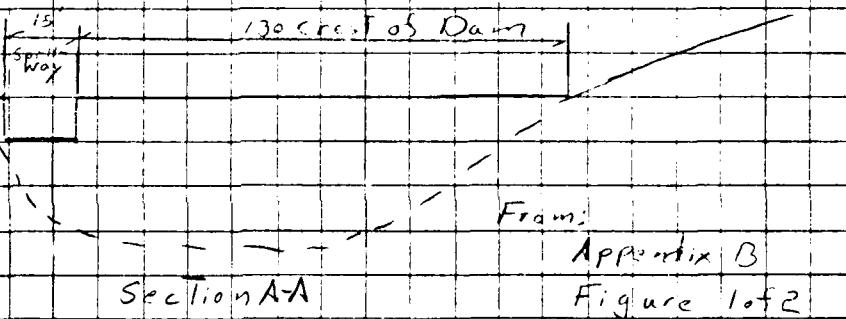
Determining effect of Vandell failure on
Stage of Cox Reservoir.

1. Routed Failure Flow into Cox Reservoir

$$Q_{pf} = 8100 \text{ cfs}$$

2. Dam Section

a) Data from; "Cox District Reservoir Dam, VT 00234
Phase I Inspection Report National Dam Inspection
Program", NED-ACE, October 1977



3. Stage Discharge

Because of small spillway capacity in comparison to inflow ignore sp. max discharge and treat as full length crest crest weir.

$$\text{Then (from Cox pg D-4)} Q = C_1 H^{3/2}$$

$$C = 3.08, L = 130, IVD = H - 4.9 \text{ referenced from Spillway}$$

$$Q = (130 + 15)(3.08)(H - 4.9)^{3/2} \quad (\text{Inv. Spillway to Crest } = 4.9')$$

| <u>N.WL</u> | <u>H</u> | <u>H-4.9</u> | <u>Crest Discharge</u> | <u>Stage</u> | <u>NWL = 970</u> |
|-------------|----------|--------------|------------------------|--------------|------------------|
| 967.0 | 0 | 10 | 0 | Above NWL | |
| 972 | 5 | 0.1 | 14 | 2 | |
| 974 | 7 | 2.1 | 1360 | 4 | |
| 976 | 9 | 4.1 | 3700 | 6 | |
| 978 | 11 | 6.1 | 6730 | 8 | |
| 980 | 13 | 8.1 | 10300 | 10 | |

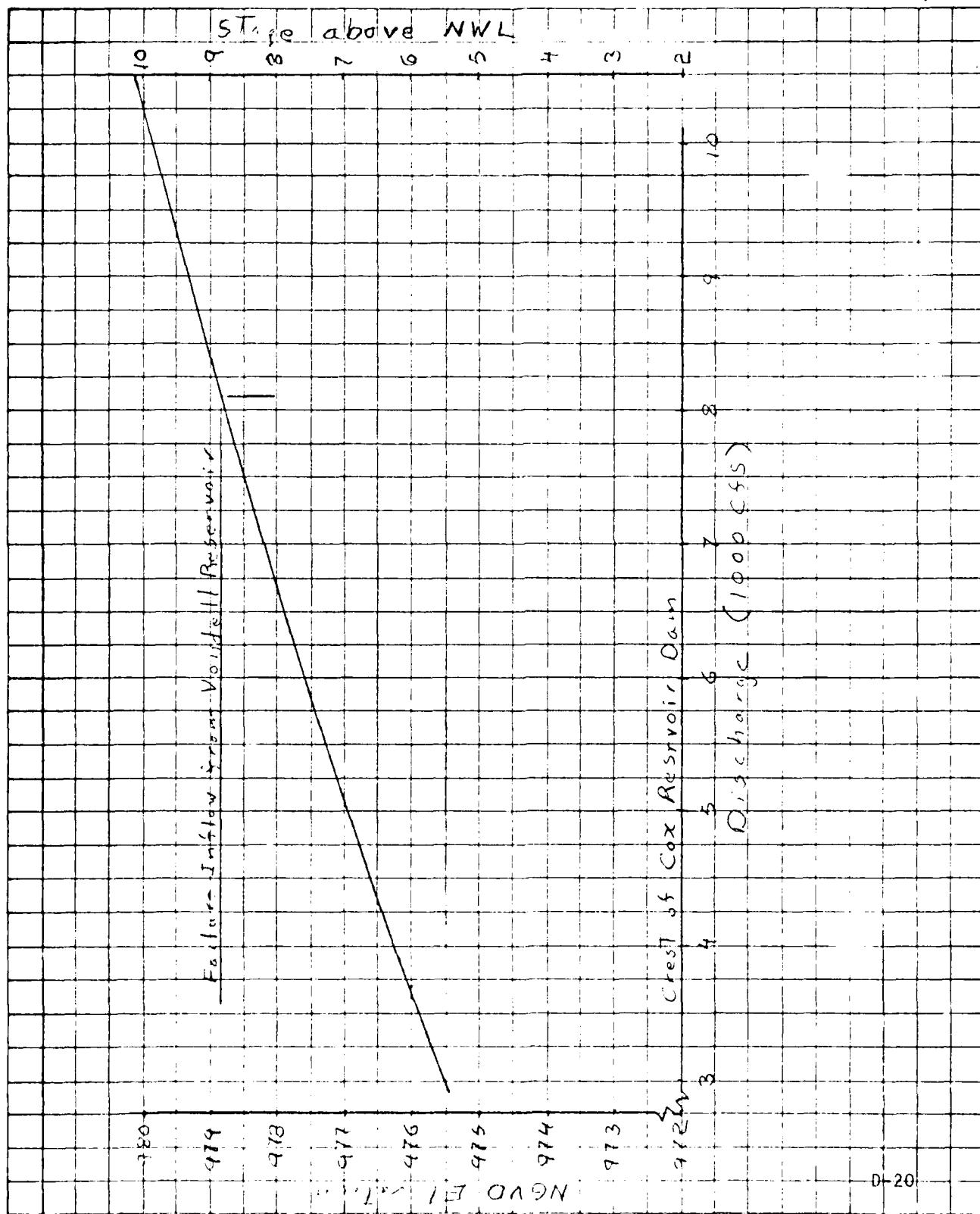
JAMES W. SEWALL COMPANY, OLD TOWN, MAINE
Civil and Sanitary Engineers

Sheet _____ of _____

Subject Inspection of Non-Federal Dam

Computation Vandell Reservoir Woodstock VT Job No. 953-05N

Computed by BW Checked by _____ Date 11-17-80



PRELIMINARY GUIDANCE
FOR ESTIMATING
MAXIMUM PROBABLE DISCHARGES
IN
PHASE I DAM SAFETY
INVESTIGATIONS

New England Division
Corps of Engineers

March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

| <u>Project</u> | <u>Q</u> (cfs) | <u>D.A.</u> (sq. mi.) | <u>MPF</u> cfs/sq. mi. |
|-----------------------|-------------------|--------------------------|---------------------------|
| 1. Hall Meadow Brook | 26,600 | 17.2 | 1,546 |
| 2. East Branch | 15,500 | 9.25 | 1,675 |
| 3. Thomaston | 158,000 | 97.2 | 1,625 |
| 4. Northfield Brook | 9,000 | 5.7 | 1,580 |
| 5. Black Rock | 35,000 | 20.4 | 1,715 |
| 6. Hancock Brook | 20,700 | 12.0 | 1,725 |
| 7. Hop Brook | 26,400 | 16.4 | 1,610 |
| 8. Tully | 47,000 | 50.0 | 940 |
| 9. Barre Falls | 61,000 | 55.0 | 1,109 |
| 10. Conant Brook | 11,900 | 7.8 | 1,525 |
| 11. Knightville | 160,000 | 162.0 | 987 |
| 12. Littleville | 98,000 | 52.3 | 1,870 |
| 13. Colebrook River | 165,000 | 118.0 | 1,400 |
| 14. Mad River | 30,000 | 18.2 | 1,650 |
| 15. Sucker Brook | 6,500 | 3.43 | 1,895 |
| 16. Union Village | 110,000 | 126.0 | 873 |
| 17. North Hartland | 199,000 | 220.0 | 904 |
| 18. North Springfield | 157,000 | 158.0 | 994 |
| 19. Ball Mountain | 190,000 | 172.0 | 1,105 |
| 20. Townshend | 228,000 | 106.0(278 total) | 820 |
| 21. Surry Mountain | 63,000 | 100.0 | 630 |
| 22. Otter Brook | 45,000 | 47.0 | 957 |
| 23. Birch Hill | 88,500 | 175.0 | 505 |
| 24. East Brimfield | 73,900 | 67.5 | 1,095 |
| 25. Westville | 38,400 | 99.5(32 net) | 1,200 |
| 26. West Thompson | 85,000 | 173.5(74 net) | 1,150 |
| 27. Hodges Village | 35,600 | 31.1 | 1,145 |
| 28. Buffumville | 36,500 | 26.5 | 1,377 |
| 29. Mansfield Hollow | 125,000 | 159.0 | 786 |
| 30. West Hill | 26,000 | 28.0 | 928 |
| 31. Franklin Falls | 210,000 | 1000.0 | 210 |
| 32. Blackwater | 66,500 | 128.0 | 520 |
| 33. Hopkinton | 135,000 | 426.0 | 316 |
| 34. Everett | 68,000 | 64.0 | 1,062 |
| 35. MacDowell | 36,300 | 44.0 | 825 |

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

| <u>River</u> | <u>SPF</u> <u>(cfs)</u> | <u>D.A.</u> <u>(sq. mi.)</u> | <u>MPF</u> <u>(cfs/sq. mi.)</u> |
|-------------------------|----------------------------|---------------------------------|------------------------------------|
| 1. Pawtuxet River | 19,000 | 200 | 190 |
| 2. Mill River (R.I.) | 8,500 | 34 | 500 |
| 3. Peters River (R.I.) | 3,200 | 13 | 490 |
| 4. Kettle Brook | 8,000 | 30 | 530 |
| 5. Sudbury River. | 11,700 | 86 | 270 |
| 6. Indian Brook (Hopk.) | 1,000 | 5.9 | 340 |
| 7. Charles River. | 6,000 | 184 | 65 |
| 8. Blackstone River. | 43,000 | 416 | 200 |
| 9. Quinebaug River | 55,000 | 331 | 330 |

AD A156 941

NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS
VONDELL RESERVOIR DAM..(U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV OCT 80

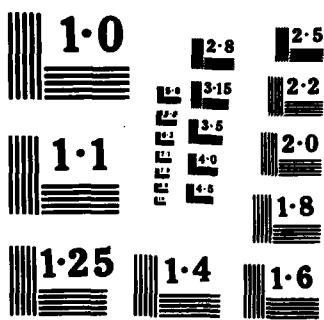
2/2

UNCLASSIFIED

F/G 13/13

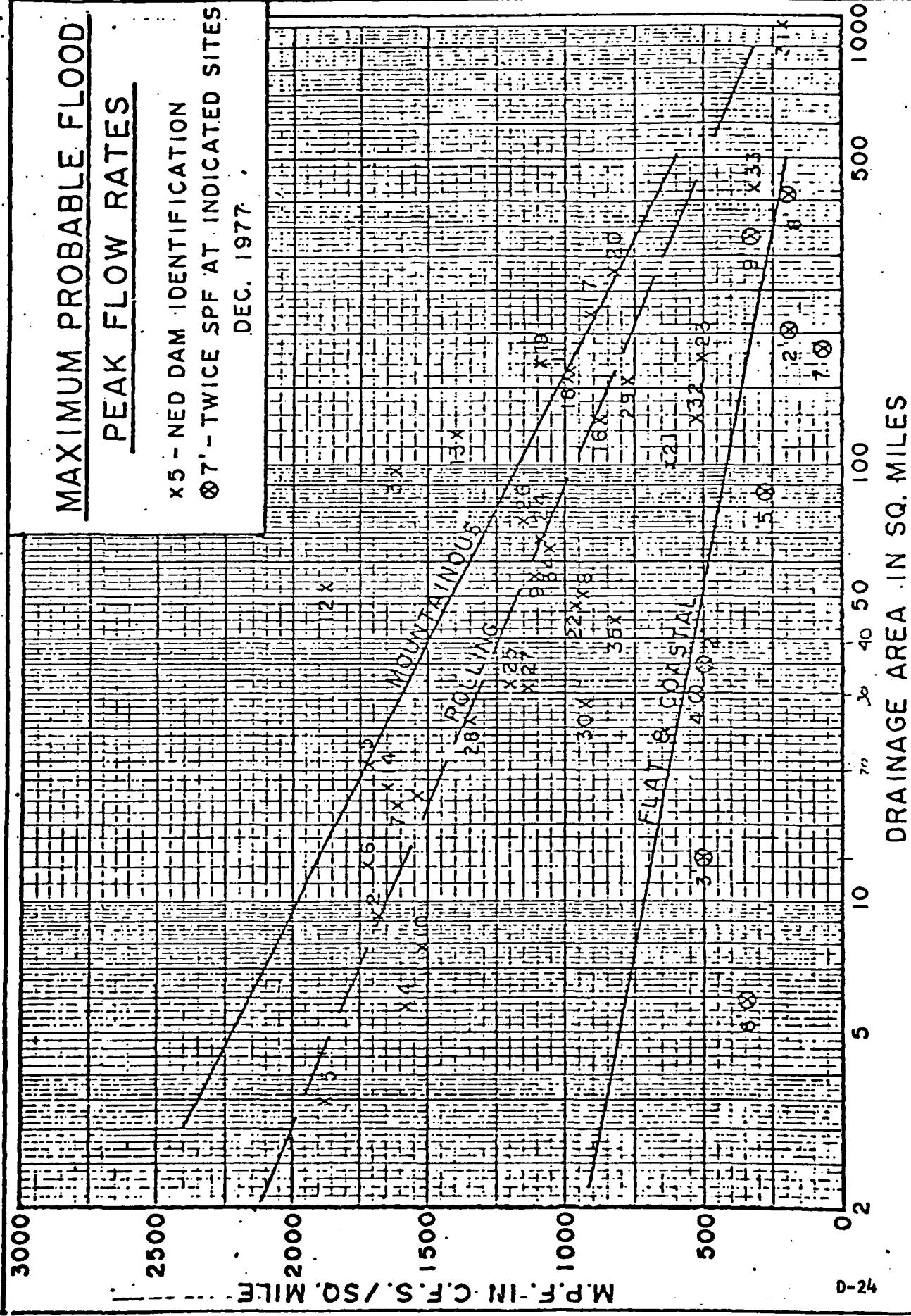
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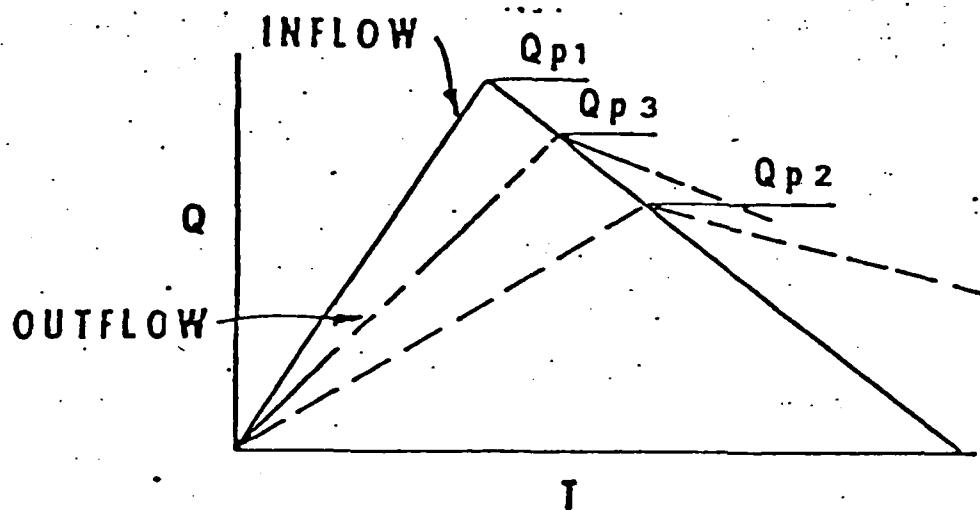


MAXIMUM PROBABLE FLOOD
PEAK FLOW RATES

x 5 - NED DAM IDENTIFICATION
 ® 7' - TWICE SPF AT INDICATED SITES
 DEC. 1977.



ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Q_{p1}) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass " Q_{p1} ".

b. Determine Volume of Surcharge ($STOR_1$) in Inches of Runoff.

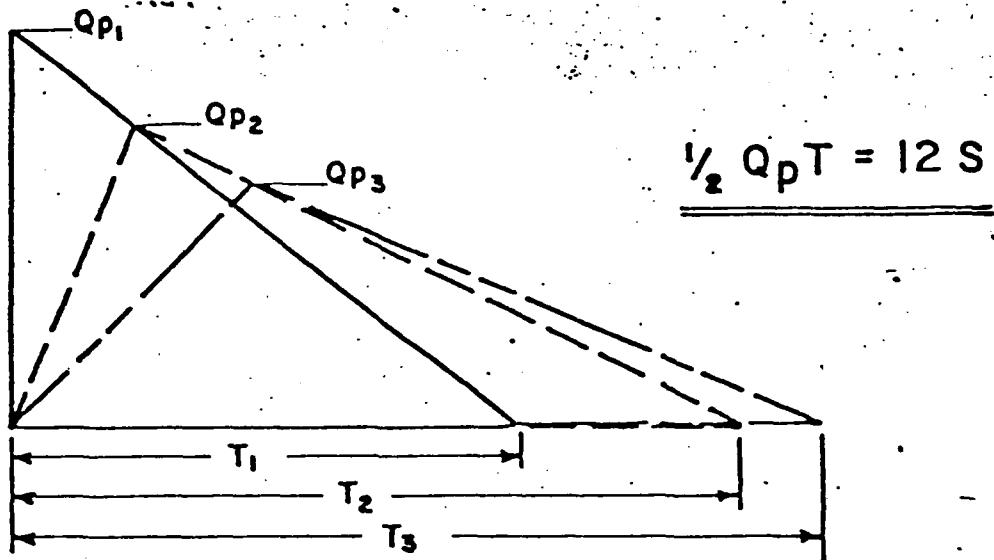
c. Maximum Probable Flood Runoff in New England equals Approx. 19", Therefore:

$$Q_{p2} = Q_{p1} \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and " $STOR_2$ " To Pass " Q_{p2} "

b. Average " $STOR_1$ " and " $STOR_2$ " and Determine Average Surcharge and Resulting Peak Outflow " Q_{p3} ".

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Q_{p1} = \frac{8}{27} W_b \sqrt{g} Y_0^{3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_0 = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOMPANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2} .

$$Q_{p2}(\text{TRIAL}) = Q_{p1} \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2} .

$$Q_{p2} = Q_{p1} \left(1 - \frac{V_1 + V_2}{2S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

APPENDIX E
INFORMATION AS CONTAINED IN
THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

| | | | | | | | | |
|---------------------------------|------------|---------|----------|-------------------|--|---------------------|-----------------------|----------------------------|
| ① STATE NUMBER | ② DIVISION | ③ STATE | ④ COUNTY | ⑤ COUNTRY DIST. | ⑥ NAME | ⑦ LATITUDE NORTH | ⑧ LONGITUDE (WEST) | ⑨ REPORT DATE DAY NO YR |
| 140 469 | V | 1027 | 01 | VONDELL RESERVOIR | | 4337.7 | 7234.1 | 150CT60 |
| ⑩ POPULAR NAME | | | | | ⑪ NAME OF IMPOUNDMENT | | | |
| | | | | | VONDELL RESERVOIR | | | |
| ⑫ REGION BASIN | | | | | ⑬ NEAREST DOWNSTREAM CITY-TOWN-VILLAGE | | | |
| ⑭ RIVER OR STREAM | | | | | ⑮ POPULATION | | | |
| ⑯ 01 OF VONDELL BROOK | | | | | ⑰ WEST WOODSTOCK | | | |
| ⑲ TYPE OF DAM COMPLETED | | | | | ⑳ SPILLWAY TYPE HAS LENGTH | | | |
| RE | | | | | 3 | 33 | 33 | 73 |
| 1962 | | | | | 60 | 1470 | 22270 | NED N N N N |
| ⑳ MAXIMUM DISCHARGE (FPM) | | | | | ⑳ IMPOUNDING CAPACITIES MAXIMUM MEAN MINIMUM (AVERAGE) | | | |
| 530 U | | | | | 116 | 116 | 73 | 150CT60 |
| ⑳ OWNER | | | | | ⑳ ENGINEERING BY | | | |
| WOODSTOCK A&P CO | | | | | GRATIDI ENGINEERING CO | | | |
| ⑳ DESIGN | | | | | ⑳ CONSTRUCTION | | | |
| WATER RESOURCES BD | | | | | ⑳ REGULATORY AGENCY | | | |
| INSPECTION BY | | | | | ⑳ OPERATION | | | |
| J W SMALL CO FOR CORPS OF ENGRS | | | | | ⑳ MAINTENANCE | | | |
| USAGB0 | | | | | ⑳ WATER RESOURCES BD | | | |
| CONTRACT NO. DACH 33-60-C-0051 | | | | | ⑳ WATER RESOURCES BD | | | |
| | | | | | ⑳ AUTHORITY FOR INSPECTION | | | |
| | | | | | ⑳ INSPECTION DATE DAY NO YR | | | |
| | | | | | ⑳ REMARKS | | | |

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-8